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OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania;

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED

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JANUARY, 1832.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

NOTES OF AN OBSERVER *on an opinion respecting the Draft in Chimneys; and on another relating to Inertia, which appeared in this Journal.*

IN vol. iii. p. 352, of the Journal of the Franklin Institute, there are some very judicious answers given to some queries on the subject of draft in chimneys. I think, however, the author is wrong in his answer to the 5th question. "Will a chimney largest at the top, or vice versa, make the strongest draft?"

Ans. "As that portion of the column of heated air, &c. nearest the burning coals, must necessarily be more expanded, and require more room than at the top of the chimney, where their temperature and volume are diminished, a chimney largest at the bottom must be better calculated to promote a rapid current through it, than the same chimney with its apex reversed." The reason here given is extremely plausible, but I would not rely on it, without experiment, for the following reasons. First, if the upper part of the chimney is enlarged, the friction will be diminished by the diminished velocity. Second, it is highly probable that elastic fluids flowing through tubes, have their flow increased by expanding tubes—on the principle of Venturi's adjutages. [See vol. iv. p. 282 of this journal. See also experiments of the Institute, hereafter to be published.] Because, from the very nature of inertia, whatever velocity may be generated in the lower part, if contracted, it inclines to preserve the same in the wider part above, and thus to increase the draft.

However this may be, I have one remark to make which will be useful to those whose houses smoke in windy weather, or whose furnaces draw worse in windy weather than in calm.

Let a roof, or inclined plane, be made of tin, or sheet iron, or boards, from the top of the chimney walls, outwards and downwards, at an angle of 45 degrees with the perpendicular walls; extending two or three feet from the top each way, more or less, according to the size of the chimney. With such an arrangement at the top of a chimney, the draft will be greatly increased by a strong wind. The experiment has been tried at the suggestion of the writer of this paragraph, with complete success. The modus operandi is obvious. The more violently the wind blows, the more will the weight of the column of air over the chimney be lifted up by the oblique direction given to it by its striking against the plane; that is, a partial vacuum will be created exactly over the top of the chimney.

It is known that a draft in a chimney may be increased by letting into it highly condensed steam, through a pipe opening upwards: and I have been told by practical engineers, that a greater effect is produced by letting the pipe open low down in the chimney, than near the top.

The reason appears to me to be that the velocity given to the gases in the chimney near the bottom, is nearly preserved throughout its whole extent by the nature of inertia.

It might be curious to inquire, what is the velocity with which air moves upwards in a chimney of a given height, with a given temperature above the air on the outside. Now it is known that if the atmosphere were of a uniform density, equal to that at the surface of the earth, it would be twenty-seven thousand feet high. If a body were to fall freely in vacuo from this height to the earth, it would acquire a velocity of thirteen hundred and thirty feet per second, and this is the velocity with which air would rush, by its own pressure, into a vacuum.

It is also known that the velocity with which fluids are discharged under different pressures, is as the square roots of those pressures; that is, four times the pressure will give double the velocity, and nine times the pressure three times the velocity, &c. If there is pressure both ways, as in the case of one fluid rushing into another, with different heads of pressure, then the velocity will be proportional to the square roots of the differences of pressure. For example, suppose two vessels filled with water, one twenty-seven thousand feet high, and the other sixteen feet higher, and a communication made between these two vessels, either near the top or bottom, the fluid would be discharged with a velocity due to a head of sixteen feet. For the writer of this article demonstrated by experiment, (see this Journal, vol. ii. p. 61,) that water makes no resistance to water issuing under a given head. The same law will apply to the gases; consequently the resistance at the top of the chimney to the issuing air is nothing. If, now, we ascertain how much less air there is in a chimney in consequence of its rarefaction by heat, we shall be able to calculate the velocity with which the external air moves upwards into it, by the following very simple rule—*Multiply the square root of the number of feet which the chimney contains in perpendicular height, less than a column of air of the same height on the outside, by eight, and the product will be the velocity in feet per second with which the air will move*

into the chimney. Now it is known that air, at the temperature of thirty-two degrees of Fah. has its bulk doubled by an increase of four hundred and eighty degrees of temperature. Suppose, for example, that a chimney is thirty-two feet high, and the temperature of the air on the outside is thirty-two degrees, and the temperature of the air in the chimney, at a mean, four hundred and eighty above thirty-*two*, then will the quantity of air in the inside of the chimney be *only* one-half of what it is in a column on the outside of similar *height*. The difference of head then will be sixteen feet. The square root of sixteen is four, and this square root multiplied by eight, the product is thirty-two, which is the velocity with which the air moves per second into the chimney.

Again, suppose the chimney is eight feet high, and the temperatures as before. Then will the quantity of air on the outside be four perpendicular feet more than that in the chimney. The square root of four is two, and two multiplied by eight is sixteen, which is the velocity of the air passing into the chimney. Again, suppose the chimney to be two feet high, and the temperatures as before, then will the difference of head be one foot, and the square root of one is one, and one multiplied by eight, is eight—the velocity per second, in feet, with which the external air moves upwards into the chimney.

As the temperature of the air on the outside of the chimney is not always thirty-two, it is desirable to know what the volume of such air would be at thirty-two.

It may be obtained by the following rule. First, for temperatures above thirty-two. *Add the number of degrees of Fah. above thirty-two, to four hundred and eighty, and divide four hundred and eighty times the volume of air on the outside of the chimney by the sum, and the quotient will be the volume of air at the temperature of thirty-two.* Again for temperatures below thirty-two. *Subtract the number of degrees of Fah. below thirty-two from four hundred and eighty, and divide four hundred and eighty times the volume of air on the outside of the chimney by the remainder, and the quotient will be the volume of air at the temperature of thirty-two.*

As we have now before us data for calculating the velocity with which air rushes into a chimney at any temperature without and within, we will illustrate the rules by one more example. Let the chimney be 32 feet high, and the temperature on the outside be 60 degrees above, and in the inside 480 degrees above 32. Now let 480 times 32 be divided by 480 added to 60, and the quotient will be $28\frac{4}{10}$ feet, the column of air on the outside at the temperature of 32. Again, let 480 times 32 be divided by 480 added to 480, and the quotient will be 16 feet, the column of air in the inside of the chimney at the temperature of 32; therefore, the difference of the heads of pressure in this case is 16 subtracted from 28.4, which is 12.4.

If, now, according to the rule given above, the square root of 12.4 be multiplied by 8, the product will be $28\frac{17}{100}$ feet, the velocity with which air at a density due to the temperature of 32, will flow into a chimney at the above temperatures.

In these calculations no allowance is made for friction along the sides of the chimney, and in passing through the fuel at the entrance. Neither has any notice been taken of the fact that the gases which pass up the chimney, after having performed the office of combustion, are always of greater weight than the air which enters.

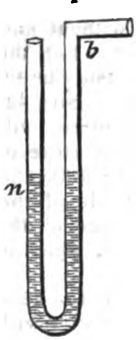
Even when pure dry carbon is the fuel, if all the oxygen of the air which enters, unites with it, the gas which ascends in the chimney is seven and a half per cent. heavier than the air which performs the combustion; and this alone will always diminish the velocity of the entering air more than seven and a half per cent, for that much more matter has to be put in motion with a velocity greater than that of the entering air.

If wet materials are used for combustion, the diminution of velocity will be much greater.

It will be seen from the above examples, that a chimney thirty-two feet high, gives a velocity only double that of one which is one-fourth as high, and only four times greater than that of one which is one-sixteenth as high. And in general the velocity of air moving up chimneys of different heights, with the same mean temperatures, neglecting friction, is as the square roots of their heights.

These calculations are all made on the supposition that the chimney is of the same diameter throughout. The writer believes the draft would be increased below if the chimney should be widened out a little above the fire; but the exact form, best suited to produce the greatest effect, must be ascertained by experiment. This much may be said, that if the object should be to burn as much coal as possible in a chimney of a given height and diameter, so as to produce the most intense heat possible by a natural draft, the chimney should be of a shape somewhat like Venturi's adjutage, with the fire in the "contracted vein."

If the principles explained above are clearly comprehended, it will be extremely easy to understand another method of ascertaining the velocity with which air rushes up a chimney at any moment, which I now proceed to explain.



Let a tube of glass, of any convenient diameter, of equal bore throughout, be bent as in the adjoining figure, so that its two legs may be parallel, and one of them, near the top, be bent at right angles, as at *b*. If, now, these two legs be filled to a certain height, *n*, with water, care being taken to keep the legs vertical, and the end *b*, thrust into the chimney just above the fire place, the water will rise in the leg *b*, and sink in the other. Now as water is 800 times heavier than air, if the difference of the heights of the water in the two legs be multiplied by 800, it will give the head of pressure of air on the outside of the chimney above that within.

If this be reduced to feet, and the square root of the feet be multiplied by eight, it will give the velocity of the air rushing into the chimney as before. Suppose the difference of the

height of the water in the two legs is four-tenths of an inch; 900 times four-tenths of an inch is $26\frac{66}{100}$ feet, and the square root of this, multiplied by 8, is 41 feet; which is the velocity with which air rushes into the chimney where the leg of this anemometer is inserted.

As the method by the anemometer gives the actual velocity, free from the uncertainty of friction in the chimney, it will be superior to the former, if no uncertainty should arise from the difficulty of measuring the depression of water in the tube.

I am aware that these calculations are founded principally on theoretical principles, and that they give a velocity about one-sixth greater than Dr. Hutton's experiments on the impulse of air in motion, which appears to me to be the converse of the principles calculated above; yet as experiments differ very widely among themselves, so as to leave great doubt on the subject, and as my calculations are founded on acknowledged principles, I do not hesitate to present them to the readers of the Journal of the Franklin Institute.

In vol. iv. p. 34, there is an essay by Thomas W. Bakewell, Esq. a gentleman who discovers much acuteness of mind on various subjects discussed by him in this journal, which, for that very reason, is the more deserving of notice, since the weight of his authority, if uncontradicted, might with many be considered sufficient to subvert a doctrine which has been universally admitted among philosophers as resting on the immoveable basis of demonstration.

The chief object of the essay under consideration is to show that inertia varies with gravitation. The author says, "If a hundred pound ball were taken to such a distance from the earth as should lessen the attracting force, or weight, to one pound, it would have lost 99 per cent. of its weight or attracting quality, and also 99 per cent. of its impeding quality, inertia, and would therefore be in exactly *the same situation as* a ball weighing one pound is, when sixteen feet from the earth, and would consequently fall from this point, in one second of time."

Now this is mere hypothesis, and is besides contrary to known facts. For instance, if the author will put himself to the trouble to calculate how far the moon deviates from a tangent to her orbit in one second of time, he will find that instead of falling below it sixteen feet as his doctrine requires, she falls only $\frac{1}{3600}$ of sixteen feet, the exact distance she should fall on supposition that her inertia is undiminished by her removal from the earth's centre sixty times as far as a body at the surface of the earth, where it is known by experiment she would deviate from a tangent sixteen feet in a second of time, provided she weighs only one hundred pounds. For if the received law of gravitation is correct, and Mr. Bakewell seems to admit it, then the gravitation of the moon to the earth, is only $\frac{1}{3600}$ of what it would be if she was at the earth's surface; that is, sixty times as near the centre of attraction; for sixty times sixty is thirty-six hundred.

If Mr. Bakewell is not satisfied with this single fact, which appears to me decisive, let him calculate how far the several planets fall below a tangent to their orbits in a second of time, and he will

find they fall exactly as far as they should do, on supposition that their inertia is neither increased nor diminished by gravitation. The method of making the calculation, a demonstration of which is given in *mechanics*, is the following—*Multiply the number of feet which a planet moves in its orbit in one second of time, by itself, and divide the product by the diameter, in feet, and the quotient will be the number of feet which the planet deviates from a tangent in a second.* It will be found, by calculating according to this rule, that the deviations from the tangents of the orbits of all the planets, are inversely as the square of their distances from the sun.' Now if Mr. Bakewell's doctrine is true that inertia is always in proportion to gravitation, these deviations from the tangents should be equal in all the planets in equal times. For he says, "if we suppose the attraction of the earth should be increased a hundred fold, the velocity of a ball, falling sixteen feet, would not be increased or changed, because the inertia, or impeding power, would also be increased at the same rate, and therefore under every degree of gravitating force, or whatever may be the quantities of matter contained in the bodies acted upon by it, the velocity with which they obey it, is as the rule for falling bodies near the earth, sixteen feet the first second," &c.

Again he says, "if the earth were divested of the motion in its orbit round the sun, and, consequently, of its centrifugal force, it would fall to that body under the same law, and commence its career at the same rate that an apple falls from a tree, viz. sixteen feet the first second, &c." For the sake of testing the correctness of this opinion, as well as illustrating the rule given above, let us actually calculate how far the earth deviates from a tangent to its orbit in one second of time; for this is the exact distance it would fall towards the sun in one second, if its projectile force were destroyed. Suppose its distance to be ninety-six millions of miles; its orbit then will be 3.1416 times twice 96,000,000 = 603187200 miles nearly. This multiplied by 5280, the number of feet in a mile, gives 3184828416000 the number of feet in the earth's orbit. This number again being divided by 31557600, the number of seconds in a year, gives 100921 feet, nearly, for the distance the earth moves in her orbit, in one second of time. The square of this last number, that is, the number multiplied by itself, is 10185148241 and this divided by 1013760000000, the number of feet in the diameter of the earth's orbit, gives .01004 feet, the distance which the earth would fall towards the sun in one second, if her projectile motion were destroyed. That is, she would fall but little more than one-ninth of an inch, instead of sixteen feet.

By calculating in a similar manner the distance which Herschell falls from the tangent of his orbit in a second, by the force of the sun's attraction, it will be found to be nearly 361 times less than that of the earth, for Herschell is nearly nineteen times further from the sun than the earth, and 19 times 19 is 361.

Mr. Bakewell says, "a friend of mine thinks that the tides make against my theory; for if the waters on the earth are at all influenced by the moon's attraction, they ought to fall to it at once."

I agree with this friend, and I think if Mr. Bakewell examines again what he has written in answer to this objection, he will find he has said nothing to show the possibility of there being a tide on the opposite side of the earth from the moon.

Indeed some of the consequences of Mr. Bakewell's hypothesis are so evidently absurd, that I cannot imagine how it could have been entertained for a moment by a gentleman who, in some of his subsequent essays, manifested a very acute mind.

For example: If there were only two bodies in the universe, one indefinitely large, the other indefinitely small; for instance, the sun and a grain of sand; by this hypothesis they would fall towards each other with equal velocities, and would move the same distance the first second, when placed one thousand millions of miles apart, as if they were separated only one hundred yards.

According to Kepler's law, which is not hypothetical, but derived from patient observation, the squares of the periodic times of all the planets round the sun are as the cubes of their distances: according to Mr. Bakewell's hypothesis, the periodic times would be as the square roots of the distances. Again, from Kepler's law it is known that the velocities of the planets in their orbits is *inversely* as the square roots of their distances: whereas, by Mr. Bakewell's hypothesis the velocities would be *directly* as the square roots of their distances. Let us take one example. Suppose a planet four times as far from the sun, as the earth, and suppose, according to the hypothesis, it falls from a tangent to its orbit, the same distance as the earth falls, it may be shown by geometry that it must move twice as far in its orbit to be the same distance from the tangent as the earth is, in the same time, which moves in a circle four times less.

In like manner it may be shown that if a planet is nine times as far from the sun as the earth is, it will have to move three times as far in its orbit, to be removed the same distance from the tangent, at the end of a second, as the earth is. Now, according to the law which actually exists in nature, the earth moves three times as fast as a planet which is nine times as far from the sun as itself: whereas, according to the hypothetical law we are examining, the planet would move three times as fast as the earth.

If this article should be successful in freeing an active and ingenious mind from the trammels of a false hypothesis, on a subject of high importance, it will not have been written in vain.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Notes of an Observer *respecting the centrifugal force of a body revolving in a given circle.*

In the 5th volume of the Journal of the Franklin Institute, page 52, is the following question—"What is the absolute centrifugal force of a given body, revolving in a given circle, with a given velocity?"

The answer there given is correct, with the exception of $16\frac{1}{2}$ being

used for $16\frac{1}{12}$. The general reader, however, who is unacquainted with algebraic notation will find the following method of calculating centrifugal force more intelligible.

In mechanics it is demonstrated that if a body moves in a circle, sixteen feet in diameter, with a velocity of sixteen feet per second, its centrifugal force is just equal to gravity; that is, its centrifugal force is equal to its own weight.

It is also shown that the centrifugal force is directly as the square of the velocity, and inversely as the diameter of the circle in which the body moves. From these principles the following very simple rule is derived. *Multiply the weight of the body in pounds by the square of the number of feet passed over in a second of time, then divide the product thus obtained by sixteen times the diameter of the circle in feet, the quotient will be the absolute centrifugal force in pounds.*

For example, "Let one of the balls of a governor of an engine, weigh thirty pounds; and suppose that it revolves in a circle the diameter of which is three feet, in one second of time." Here the number of feet passed over in a second is first obtained by multiplying the diameter by 3.1416, because the circumference of any circle is 3.1416 times greater than its diameter; but three times 3.1416 is 9.42, which is the velocity in feet per second; now square 9.42, and the result will be 88.54. This square being multiplied by 30, the weight of the ball, gives 2656.2. Now divide this quantity by sixteen times the diameter, $16\times3=48$, and the quotient will be 55.33 pounds, the centrifugal force.

If the reader wishes to become familiar with the laws of centrifugal force, let him propose to himself a number of such questions as the following; and first, let the velocity be constant, for example, sixteen feet per second.

What will be the centrifugal force of the ball mentioned above, weighing 30 pounds, in circles of the diameters 16 feet, 32 feet, and 64 feet. He will find the answer to the first question will be 30, to the second 15, and to the third $7\frac{1}{2}$.

Let him then vary the velocity, keeping the diameter the same; for example 16 feet. What will the centrifugal force be with the following velocities, 16 feet per second, 32 feet per second, and 64 feet per second? He will find the respective answers to be 30 pounds, 120 pounds, and 480 pounds. He may then proceed to vary both the circle and the velocity. For example, if the diameter is 4 feet, and velocity 8 feet, he will find the answer to be 30 pounds, or equal to gravity. If the diameter is one foot, and the velocity four feet per second, the answer will be 30 pounds. If the diameter is one foot, and the velocity is eight feet, the answer will be 120 pounds.

By considering the velocities with which pendulums move at their lowest point, in connexion with the above principles, I discovered the following curious law. *If any pendulum oscillates in an arc of a circle, whose cord divides radius into two equal parts, its centrifugal force at the lowest point is just equal to gravity.* In other words, if any pendulum be drawn out of the line of direction until its perpendicular height above its lowest point shall be one-half its own length,

then will the tension of the cord by which it is suspended at this lower point of oscillation be just twice as great as when the pendulum is hanging at rest. This law may be tested by as many examples as the reader pleases. I shall propose two. Suppose a pendulum two feet long drawn up the arc of its circle, until its perpendicular height is one-half its own length; in oscillating it will descend one foot in perpendicular height. Now it is known from the laws of falling bodies, that in falling freely one foot perpendicular height, either in the line of direction, or on an inclined plane, or in a curve as of a pendulum, it will acquire a velocity of eight feet per second, and according to the rules mentioned above, if a body moves in a circle four feet in diameter, with a velocity of eight feet per second, its centrifugal force will just equal gravity. Suppose now the pendulum is eight feet long, and let it be drawn till it is four feet above a line drawn horizontally through the lowest point of the curve. Now this pendulum moves in an arc of a circle which is sixteen feet in diameter, and at its lowest point, according to the laws of falling bodies, its velocity is 16 feet per second, and with such a velocity, and such a circle, its centrifugal force will be found to be equal to gravity.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Description of an improvement in the mode of Balancing Mill Stones.

Sir,—I offer the following improvement for your consideration, and if you think it worthy, you will please publish it in the Journal of the Franklin Institute. It consists of an alteration in the balance rine and driver, for balancing the running mill stone, obviating the necessity of taking up the stone to remove the rine, and afterwards adjusting the driver so that each prong shall have its full bearing; which improvement will also obviate the necessity of taking out the spindle to adjust and fix the rine and driver as heretofore.

I take a common three pronged balance rine, such as is commonly used, then I rivet, or otherwise secure, a three-cornered box on the under side of the top of said rine, so that each corner may rest on the under side of each prong. On each side of this box I fix a set screw, to act on a small block of iron, steel, or other metal, with a centre hole punched in it to admit of the cock head, or upper end of the spindle to rest in. This small block, by working the screws, will move the running stone, and admit of balancing it on the head of the spindle to any nicety; after the runner is well balanced I apply a sufficient force to the wallower on the spindle to bring up the driver to its bearing. Then I take a common three-pronged driver, and fix each prong askew, so as to stand square with the prongs of the rine on the driving side, then the prongs being no longer than the size of the eye of the mill stone, and when fixed on the spindle the lower side of driver and rine being of an equal distance from the face of the bed stone, I insert, through the driver, on each prong, a set screw to

work against each prong of the rine, and to set the said screws. After the runner is well balanced, I apply a sufficient force to the wallower, on the spindle, to bring up the driver to its bearing; then, with a wrench, I screw up the screws that are wanting to come up to the prong of the balance rine, each to a full bearing, so, as I have before stated, that the runner can be justly balanced, and the driver set to its proper bearing, without any cause of taking out the spindle. I have had one in operation some time, on the above principle; it more than answers my anticipations.

Yours, respectfully,

Daniel Lamb.

Almonisson Mills, near Woodbury, N. J. July, 1831.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Practical Observations on the good and bad properties of the colours used by artists. By Joshua Shaw.

Philadelphia, December 28, 1831.

Sir,—Having, in the way of my profession, and by long experience and practical experiment, made myself acquainted with the good and bad qualities of the colours in general use with artists, I am inclined to believe that the results, if made public, would be found of much interest to the profession, as well as to connoisseurs and lovers of the art in general; and believing the Journal of the Franklin Institute to be a useful and legitimate channel through which to furnish the information, I submit the first of a series of remarks, or essays, which I have in contemplation, to your inspection, and which, if approved of, you will please to lay before your readers. You are not to consider my observations as the result of *chemical* experiment in the laboratory, of which an artist, generally speaking, can be expected to know but little; about as much, perhaps, as a chemist generally knows of painting. I pretend to very little knowledge of the art of manufacturing colours, and shall confine myself to their application upon canvass, their disposition to change, or such other qualifications as may render them valuable or otherwise. My limited knowledge of science as applied to chemistry, or to books, does not enable me to say whether I am in the track of any predecessor or not; but it is a fact as plain to me as noon day, that there is an unaccountable difference between the productions of the ancient and modern artists; I speak with reference to colours themselves, and the modes of their application, without the most distant idea of contrasting those merits which belong to composition or design, for in this respect, the balance is certainly with the present generation, notwithstanding any thing which may be said to the contrary by the affected babbling connoisseur, who in every age has been the same dissatisfied malcontent, decrying living merit.

I shall commence with remarks on blues, and the following, to-

gether with the preceding observations, may be given together as constituting the first division of my undertaking.

Prussian blue is a combination of oxide of iron with cyanogen, upon an aluminous base. It is the most common blue in use among artists, and from whom, owing to long acquaintance with it, there seems to be but little chance of an immediate separation—such is the force of habit. Prussian blue is an intensely deep pigment, and cheapness alone must have been the principal cause of its general adoption; however, few, or none, will envy the feelings of the artist who, on that account, shall continue to use it; his reputation must soon suffer from its liability to change, and the penalty thus incurred will be of infinitely greater disadvantage than any difference of price between it and other materials of a more permanent nature. In large compositions, and in portraits, where broad draperies are required, it may be employed to some advantage, if employed in the following manner—it should be reduced with white, and in every part left much lighter than intended to be when finished, and when dry, increased to the proper depth by a thin coat or glazing of Antwerp or fine cobalt blue, by which means it will be protected from the effects to which it otherwise is liable when in contact with atmospheric air, from which it suffers materially, changing by degrees to a dirty olive green. I know not upon what principle this change is effected, but I speak of results, and leave the causes to be explained by those who know more of chemistry than I do.

Its intensity and heaviness are equally against it, and, if there were no other, these should furnish sufficient objections for continuing its use. The least skilful in art, as well as the genuine connoisseur, must have observed in all the works of the old masters, whether good or bad, that all their deeper tones are clear and transparent, and if so after the lapse of a century, it is certain they were equally so when they left the easel of the painter.

With respect to the greater proportion of the works of modern artists, it is evident that their pictures are as remarkable for qualities of a contrary nature, and it may be generally traced to their slovenly disregard as to the purity, or other good or bad qualities, inseparable from the colours they employ.

I shall now dismiss the article of Prussian blue as a totally worthless colour when applied to the fine arts, to make room for a few observations respecting the properties of indigo, the which, although it does not properly fall under the head of the present article, I shall take this opportunity to introduce, as I do not intend to make it the subject of a separate essay. Indigo, I have always been inclined to believe, possessed many superior qualities, and that it would, sooner or later, become a substitute for, and altogether supersede the use of, Prussian blue. It is laid down as a principle by artists generally, that the durability, as to colour, of vegetable preparations, is not to be depended upon; nevertheless, it is a fact, that lake, prepared from madder, is the best and most permanent of all others—why, then, should we despair of indigo? As an article of commerce, it has never been offered in a pure state, and if any experiments have been made

upon it by artists, and have ended in disappointment, I think it must be attributed to the fact, that it contains much of foreign and unfriendly alloy.

The blue vat of the dyer contains indigo deoxidised by protoxide of iron, and rendered soluble, in its yellow green state, by lime water. If a portion of this solution be exposed to the air in a shallow vessel, the indigo will speedily absorb oxygen, and be precipitated in its usual state of an insoluble blue powder; this being dried and digested in a mixture of alcohol and muriatic acid, becomes pure indigo, by the abstraction of all the resin and lime contained in it. Thus prepared, it is a fine powder, intensely deep, but soft and tender in its tint, resembling ultramarine, and does not change when exposed to the air. There is but little doubt that if *pure indigo*, prepared as above, or in any other way more convenient to the chemist, was procurable at the colour stores, it would be found to be a most valuable substitute for the preceding article; for if it will stand the action of light and air, as it certainly does, unprotected by an oily or mucilaginous matter, it would be an acquisition to the palette of no ordinary kind, and prove the most valuable of all other blues when prepared in cakes for wash drawings, and for the use of miniature painters. It is well known that vegetable productions, when they can be depended upon, are, in most instances, preferable to minerals; as applied to water colours they certainly are; they flow freer from the pencil, are more vivid and more convenient to manage.

I am, &c.

JOSHUA SHAW.

Note.—If, in the course of my intended remarks, I should be induced to refer occasionally to known pictures, for the sake of making comparisons, and thereby enabling the painter to form his own judgment as to the truth of my observations, it is trusted that no one will take offence. The sole object of these essays is to improve the condition, and not to traduce the standing of the fine arts at home or abroad, my remarks will be general, and apply alike to every country.

FRANKLIN INSTITUTE.

Explosions of Steam Boilers.

Continued from vol. viii. p. 388.

(No. XIV.)

Extract of a letter from the Hon. S. D. Ingham, late Secretary of the Treasury, dated October 21, 1830.

I send you herewith a drawing of a boiler intended to prevent the possibility of the upper zone being heated above the temperature of boiling water, with a simple apparatus for announcing to the *crew of the boat*, the successive depression of the water. I submit it for your inspection and criticism, and would be gratified if an experiment could be made by constructing two small boilers, one on this plan, omitting the float and bell as unnecessary for this object, and one in

the usual form of a high pressure boiler, made of metal one-eighth, or one-fourth, stronger than the first, in all other respects as much alike as possible; then place them side by side in a furnace so constructed as to avoid all danger to the attendant, allowing the fire to surround them freely, and force it until they explode; several gauge cocks in each would be necessary to regulate the height of the water, which should be kept as equal as possible. The *water-guard,* as I have termed it, having no pressure on it, could be kept full with a very simple apparatus; and the supply to the boilers could be thrown in with a small forcing pump. The idea of thus surrounding the boiler with an effective nonconductor, was suggested by reading some of the papers of Mr. Perkins, and a commentary upon his experiments by Mr. Arago; but the remedies proposed by the latter appear to be rather auxiliary than effective, and generally liable to the objection that they depend for success upon a degree of care and attention on the part of the engineer, which is scarcely to be expected, or even within the reach of hope in our country. It will certainly be safer to put it out of the power of the engineer to heat the upper part of the boiler to a temperature above that of the water, than to rely upon any precautions, which depend on his care and constant attention, to regulate it by any standard that can be devised. I would not, however, dispense with the safety valves; they should be constructed in the most perfect manner, and their efficiency will be no longer doubtful when the boiler is so constructed that the elasticity of the steam must always correspond with its temperature; this point being secured, the chief remaining danger will be from raising the ordinary steam too high for the strength of the metal; the safety valve, properly constructed and secured, is perhaps the best remedy for this.

Specification of an improvement on the steam boiler, intended to prevent the explosion of steam boilers, by reason of the great heat in that part of the boiler which is above the water line; and also to give notice of the depression of the water, by the ringing of a bell.

A, A, The steam boiler filled with water to the line *e, e.*

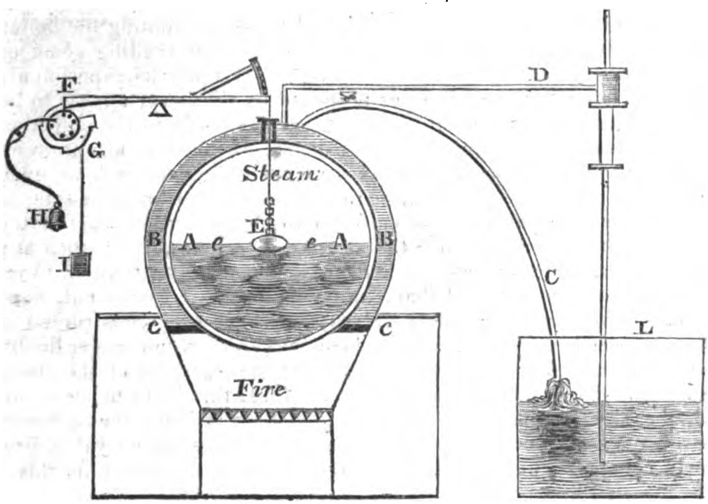
B, B, A column of water on the outer side of the boiler, called a water guard; it is confined by a casing of common sheet iron or copper, around the upper and middle parts of the boiler, meeting the fire at *c, c,* and leaving a space of 2½ inches between it and the boiler for the thickness of the column of water. This water being exposed to the atmosphere, cannot be heated above 212°, and extending so far below the surface of the water within the boiler, that no part of the iron which has not water in contact with it, shall be exposed to the fire, guards the upper and middle parts of the boiler from the intense heat communicated through the brickwork.

C, A pipe to discharge the overflowing water into the supply cistern *L.*

D, A pipe and pump to supply the water guard.

E, A concave spheroidal metallic ball, or float, so adjusted as to

float as in the drawing where the water is at *e*, *e*. A slight depression of the water raises the catch F, when the lock wheel G, propelled by the weight I, turns until the next notch meets the catch, ringing the bell H; a further depression of the water raises the catch, and the rack wheel turns to the next notch, ringing the bell more actively; a further depression of the water raises the catch above the highest notch, when the weight I runs down, ringing the bell with such violence as should be heard in every part of a steam-boat.



(No. XV.)

Extract of a letter* from Professor James Renwick, of Columbia College, New York, dated

October 27, 1830.

"As relates to that part of the improvement called the water guard: There can be no doubt that it would be certainly effectual in preventing explosions arising from the cause pointed out by Perkins, but there are extremely few cases in which it would be possible to introduce it into practice; the water in the outer vessel boiling under the ordinary pressure of the atmosphere, would not of course be heated beyond 212°, and would carry off the heat of the water and steam contained in the inner boiler so rapidly, that it would be impossible to raise their temperature more than a few degrees above 212°; now, even in the English condensing engines, the safety valve

* This letter as well as Mr. Lester's, (No. 17,) was addressed to the Hon. Samuel D. Ingham, (then Secretary of the Treasury,) by whom these extracts were kindly communicated to the committee.

is loaded with three pounds per square inch, and requires steam of a tension greater than could be attained in the proposed apparatus; in our American steam-boats, even when the engine works upon the condensing principle, the safety valve is rarely loaded with less than seven or eight pounds per inch.

"I am myself decidedly of opinion that no absolute security from explosion can be attained, until a feeding apparatus that shall depend for its action solely upon the level of the water in the boiler, and which is applicable to steam of the greatest tension, shall have been invented, and for this it would be a worthy object to offer a national reward. A small separate engine, working a forcing pump, to which the apparatus which received the prize from the British Society of Arts, would answer the purpose, but there are objections to its use, and it does not fulfil the condition I have stated."

(No. XVI.)

Extract of a letter from the Hon. S. D. Ingham, late Secretary of the Treasury, dated Nov. 1, 1830.

Since I had the honour of addressing you, I forwarded a drawing of the water guard boiler to Professor Renwick, of New York: he considers the remedy effectual against the chief cause of explosion, but is persuaded that the water in the guard will conduct the heat from the boiler so rapidly that the steam cannot be raised within, without great waste of fuel; this objection had struck me with some force in my first speculations on the subject, but had yielded to the consideration that a column of boiling water would not be likely to *conduct heat so rapidly* from the boiler as the open air at a much lower temperature; how far it would compare with a mass of brick work in this respect, can only be ascertained by experiment. I have supposed that the water guard would be a better non-conductor than the open air, and that if somewhat inferior to the mass of brick work, the defect would be made up by transmitting the escaping heat to the cistern from whence the boiler should receive its supply of water, while all that escaped into the open air or brick work would be lost. In this speculation I may be mistaken, and having great respect for the Professor's judgment, I should be gratified if you would try the experiment, whether a boiler enclosed in the ordinary form, or one with the water guard, require the most fuel to raise the steam. This objection may, however, be readily removed by constructing the water guard strong enough to bear a pressure equal to that which it is proposed to give the steam in the boiler; it will perfectly regulate the temperature of the iron, and its overflowing, which in that case should be constant, will be the admonition to the engineer that all is *right*. Professor Renwick is of opinion that the best remedy is a *constant* supply of water, and the desideratum is a contrivance for self-*feeding* to be continued while the boat stops: believing, as I do, that it is not the mixture of the whole of the water in the boiler

with all the steam, I cannot be persuaded that the depression of the water would cause an explosion, if the steam above it had not received an increased heat from the iron, and when the steam is so heated, there may be nearly the same danger when the water is at its proper height.

I enclose an extract (No. 15,) from the Professor's letter that you may consider his objections; whatever comes from him is entitled to great consideration.

(No. XVII.)

Extract of a letter from E. A. Lester, Esq. to the Secretary of the Treasury, dated

Boston, November 15, 1830.

"Having never been on board a steam-boat at the time of a boiler's exploding, nor witnessed the explosion of a steam boiler in any other situation, I am not able to give you much, if any, information in answer to your inquiries as requested in your circular of the 1st of August last, or at least none which can regularly be classed in the list of interrogatories; yet, as my experience in the use of steam in various ways, and for different purposes, has brought to my mind and notice certain facts relating thereto, among them, some which I have never seen noticed in any writings on the subject, I have concluded to communicate them to you, leaving it to your discretion to make such use of them as you may think proper.

"My first experience in steam engines commenced in 1814, in the city of Baltimore, where I was employed by Capt. George Stiles in the manufacturing of the rotary steam engines, which were operated by high steam, of great elasticity, being at times from 150 to 200 lbs. per inch pressure. The boilers, or generators, were of different metals and forms, being of copper, of wrought iron, and of composition metal pipes. During the time I was there, no accident, even of burning or overheating a generator or boiler occurred.

"Since my leaving Baltimore, I have been employed in New York, in North Carolina, and in this city, in the building and operating of engines of both high and low pressure, and have repaired many boilers in steam-boats, which had been overheated, but had not exploded. The steam-boat Eagle, of Boston, owned and commanded by Capt. John Wood, having a low pressure, or condensing, engine, with two cylinder wrought iron boilers, with cast iron heads without flues, two feet six inches in diameter, and twenty-four feet in length each, set in brick work, had her boilers very much injured in the bottoms, or under sides. The injury was attributed to negligence in not keeping them clean, a quantity of sediment having collected in the boilers, and settled at the bottom, and formed an incrustation of from two to three inches in thickness, which was, in some places, so hard as to require a hammer and chisel to disengage it from the bottom of the boilers. The metal, for nearly the length of the boilers, was in

consequence so much injured that it became necessary to repair the bottoms with new irons, and to change them; making the parts which were before the under sides, the tops or upper sides, by rolling them in their beds. This damage was sustained in the course of two or three weeks after the boilers were set or put in operation. Whether any explosion would have occurred is uncertain, as the boilers were discovered to leak immediately over the fire in the furnace, and the discharge from those places extinguished the fire.

"A steam-boat with a low pressure engine, called the Massachusetts, of this port, having two cylinder copper boilers, with return flues, was injured by suffering the water to get too low, whereby the flues were uncovered; they were in consequence condemned and taken out. On examination of them, I found the flues, the inner shells, flattened *directly underneath* the safety valve, but in every other part the form was retained. And the query has occurred to me, whether the opening of the safety valve, and shutting it suddenly, may not cause a reaction in the boiler, upon the principle of the hydraulic ram, and thus occasion the explosion. The metal, however, was so much injured by the heat as to become hard, flinty, and brittle, losing all its tenacity and malleability, and was supposed by experienced coppersmiths to be gun metal. I have also observed that wrought iron, in similar cases, undergoes a change, whereby it becomes like cast iron. The boilers being taken out, two others of wrought iron, of a cylinder form, with cylinder flues, were put in, and the boat put in operation. From the incrustation formed between the flues and boiler shells, or outer coats, and by letting the water get low, these boilers were injured and condemned also, although they were used but about three weeks.

"The steam-boat Legislator, (a boat which had a boiler exploded *in the harbour of New York*, by which several persons were injured,) plying between this port and Bath, in the state of Maine, having a low pressure, or condensing, engine, overheated her boiler in consequence of the forcing pump being out of order, whereby the water was not kept up. The oval or elliptical furnace flue was much flattened on the upper part, but before any explosion took place, the fire was extinguished, and the boiler got cool before water was forced in, or the boiler filled. I was informed by the agent who was on board at the time, that the *upper part* of the shell, or outer coat, of the boiler was afterwards discovered to have been heated to so great a degree as to burn a woollen jacket which was laying on it.

"I am of opinion that had the forcing pump been put in operation prior to cooling the boilers, the liability to an explosion would have been great. I afterwards repaired the boiler, and discovered the iron to be hard and brittle in those parts where it was much exposed to heat.

"As these are the only instances of extraordinary injuries to boilers which have come within my observation, you will perceive my information is very limited as to the subjects of your inquiry. My opinion is, that in every one of these cases, the injury might probably not have occurred, had a proper degree of attention been given

by those entrusted with the management of the machinery; at least, the injury did not arise from any defect of the materials.

"Presuming that much of the information which will be derived, as to the cause of explosions of steam boilers, will be matter of opinion, I will take the liberty of stating what has appeared to me as having been the cause of many of the explosions in the boilers on board of steam-boats in the waters of the United States. And first, to want of skill may be fairly attributed many of the accidents which have happened, whether attended with explosions or not. The introduction of steam navigation has been so rapid that men of character, capability, intelligence, skill, and sobriety, were difficult to be procured in sufficient numbers; and such, when employed, demanded liberal compensation for their services. The several owners, competitors in the various lines or routes, governed by a mistaken policy, rather than pay the wages demanded by competent and skilful engineers, have in many cases employed those as engineers whose whole knowledge consisted in understanding how to stop and start an engine; and as firemen, those whose only qualification was, that they could throw wood into the furnace. Hence, when any part of the machinery happened to be disordered, those entrusted with its management, being conscious of their want of science and skill, became incapable of applying the limited knowledge which they possessed, and injury and accident ensued.—Again, engineers and firemen on board of steam-boats have been, not unfrequently in times past, and I believe they are still, in some cases, at present, treated with intoxicating liquors by the passengers, and thereby rendered incompetent to manage the machinery."

(No. XVIII.)

Anonymous communication received from England, through P. Vaughan, Esq. of London.

Sir,—In consequence of a notice in the Mechanics' Magazine, I trouble you with this letter, and beg attention to the accompanying newspaper communication. I am of opinion that a boiler constructed with a safety plate, such as described, would not burst.

A boiler belonging to a colliery engine of mine has had such a plate on for several years, working at high pressure. A few months ago I directed the engine man to fasten down one of the ordinary safety valves, and overload the other, make a large fire under the boiler, and wait the event; he did so, and the result was the tearing asunder of the leaden plate with a loud explosion, without any damage whatever to the boiler or engine. The plate gradually thins and protrudes in the middle, and at last tears across, thus +, leaving four angular pieces standing up like spear heads.

Leaden plugs have been tried, to melt with hot steam, but this plan does not do, because it requires the steam always to be of a certain intensity before the lead can melt; whereas, an old boiler might burst

before the steam acquired such intensity. Now my plate need only be a few degrees stronger than working steam, whatever strength it be, and any thing beyond that will tear it and save the boiler.

If you have any wish, I will send the torn lead plate, and any communication will reach me through the hands of Mr. Mort, Newcastle, Staffordshire.

SAXULA.

September 8, 1830.

P. S. The efficacy of this plate is certainly such, that I think it cannot be too soon or too generally tried, previously to any extensive investigation, as I think it almost impossible to ascertain the particular causes of the bursting of many boilers, beyond the over-strength of steam; all moveable valves are liable to "gag," or stick in the sliding parts, from unforeseen, and often unknown causes. A lead plate cannot cease to act, unless a stronger be purposely screwed over it.

To the Editor of the Staffordshire Advertiser.

SIR,

"Govern these ventages with your finger and thumb."

SHAKSPEARE.

As I trust the time is fast approaching when we shall see carriages propelled by steam traversing our common roads in all directions,— but at what speed I dare not undertake to say; and as there is a very prevalent feeling of dislike to, or fear of their introduction, on account of apprehended dangers from explosion of the boilers, I have no doubt you will feel a pleasure in assisting to disperse as widely as possible, the following most simple and efficacious preventive *from any such* dreadful catastrophes.

Your readers may suppose the invention to have arisen out of the *following familiar* occurrence, which forms the strongest illustration *that I can give of* its principles and efficacy.

A narrow mouthed stone ware jar, filled with fruit, and closed by a bladder, was placed in a kettle of boiling water to stew. The sirop of the fruit soon became as hot as the water, and then steam began to form, which having no vent, at last burst the bladder and escaped. Now, had the bladder been as strong as the jar, the steam would have been confined until its strength became sufficient to burst the jar, and discharge at once its whole contents, the consequences of which may easily be imagined.

On the top of my boiler, in addition to the usual safety valves, I place a pipe of dimensions sufficient to discharge the steam gradually. The orifice of this pipe I cover with a plate of thin sheet lead, strong enough *to* hold steam of proper working strength. Now, *should* any cause obstruct or overload the safety valves, as soon as the *steam* becomes too strong, the sheet lead tears asunder and discharges it. It is impossible to burst the boiler. This, I believe, *wants no science* to make it plain, any one may understand it;—a

report will be heard, and the journey will be delayed, but no damage can ensue.

Even the "great steam chamber (A,) alias safety chamber, alias danger chamber," about which there was so much bickering a few months ago in the Mechanics' Magazine and the Register of Arts, will become with this appendage, quite harmless.

Such is the safety of this simple contrivance, that I think it would not be unworthy the notice of parliament, making it penal for a boiler to be found without it, at the same time regulating the size of the orifice, and thickness of the lead.

This security is attached to the boiler of my little steam carriage, the "Triumph," heretofore noticed in your columns; the pipe is one inch diameter, and the lead about the thickness of brown paper.

*   *   *   *   *

Yours,

May 5, 1830. SAXULA.

(No. XIX.)

To the members of the Franklin Institute.

Since the frequent disasters occurring on board of steam-boats by the explosion of boilers, public attention has been aroused, and the executive of the nation called upon by the voice of the representatives of the people for information, and also your body have called upon engineers generally for information, as to the adoption of suitable means for the prevention of those accidents which have hurried into eternity hundreds of our most valuable and highly respected fellow citizens. It therefore behooves every engineer, however humble, and however unknown to the public, after being called upon by you, to give his views, that from the united opinions of engineers on this subject, something may be gleaned which may lessen those disasters, or entirely prevent their recurrence.

The undersigned, an humble individual of the profession, not known, or wishing to be, by writing on this subject, would respectfully lay his opinion before your more enlightened judgment.

In the first place I assert, without fear of contradiction, that two-thirds of the accidents, are to be attributed to nothing but ignorance; and from this cause, that men who are perfectly acquainted with their business cannot be had except at high wages; and through a mistaken notion of economy, a fireman is taken, who has gained the experience of stopping and starting an engine, but who is entirely ignorant of its principle; aye, some who could not tell you whether the engine they were attending was high or low pressure! And thus the grandest machine ever invented, and the lives of thousands, are placed in the hands of ignorance. No wonder that explosions occur!

Secondly. It is a general rule with engineers, on both land and water, with both high and low pressure engines, that the moment they

are stopped, the safety valve is raised, and the steam let off, which I think is entirely wrong, (although it is an old practice,) for these reasons, which I submit to your better judgment. It is a rule with engine builders, to make their boilers capable of resisting twice, thrice, or four times the pressure calculated to be borne upon them; and very often when a steam engine is in operation, we see the steam *blowing* off. And why, I would ask, is not a boiler as safe when the engine is not in operation? The disadvantage in blowing off steam, I conceive to be this, that the water in the boiler is lowering and passing away in steam; whereas, should the safety valve be left down, the steam by degrees would condense in the boiler, and very little water be lost in evaporation.

Thirdly. There should be some means adopted whereby the pressure carried on safety valves should be regulated, and not leave it to ignorance to place a greater weight thereon, perhaps for the purpose of outrunning an opposition boat, or under the influence of spirituous liquor.

Fourthly. Great care should be taken at all times to have a sufficient quantity of water in the boiler, for it is a well known fact, that if the water descends below the flues of the boiler, the fire immediately acts upon the iron or copper, and it is burned through before it is possible to supply it with water.

I would now take the liberty, after the foregoing remarks on this important subject, to recommend a remedy which I think, if adopted, would lessen, or, as I have said before, prevent the recurrence of steam-boat accidents, viz. that three engineers, theoretically and practically acquainted with the business, should be appointed in different central places on all our rivers, or where steam-boat navigation extends, whose duty it should be to examine the engineers employed on board of steam-boats, as to their practical and theoretical knowledge of engineering, and after such examination a diploma or certificate should be granted them if found proficient, and that there should be a penalty imposed upon the owners of any boat who should employ an engineer on board of their boat who had not a diploma signed by the examining engineers. And also that it should be the duty of said examining engineers, to examine every boiler and prove the same, either by steam or water, as may seem to them best, and condemn every boiler which should not bear four times as much pressure as is necessary on the safety valve when the engine is in operation, and this examination to be gone through once a year. Also to regulate the pressure to be carried on every boiler, and after such regulation a penalty should be incurred by the engineer should he, from any cause whatever, place more weight on the safety valve than the examining engineers had determined should be carried thereon.

A Practical Engineer.

Philadelphia, November 2, 1830.

(No. XX.)

December 1, 1830.

Sir,—I take the liberty of communicating to you my views of the causes of the explosions that so often take place in steam boilers, agreeably to the solicitations in the circular addressed to the public by your committee of the Franklin Institute appointed for that investigation. I do not pretend that my ideas are all new, but the treatises I have seen on steam, have given less attention to some of them, than I conceive due to a full understanding of the matter.

The explosions of steam boilers, it is believed, have been much more frequent on the waters of the Mississippi river than elsewhere, and even in greater proportion to the number of engines in use. The accounts given of these disasters, report them to have occurred at landing places, or at the first working of the engine after delays, as at wood yards or towns on the river. During these delays it is to be observed that the engine is stopped from working, and the water in the boilers is diminishing by evaporation, so that a considerable portion of them above the level of the water, is left to be heated to a temperature that will rapidly produce steam when the water may be disturbed and thrown in contact with it, and afford one material cause of the explosions which take place. And although the fires are not kept up during these delays, yet there is heat enough in the furnace to keep up a high temperature, and together with the firing up before starting, is sufficient to charge the fluids within the boilers to their highest capacity while in their quiescent state with caloric. Under these circumstances, the engine is to be put in motion; when the first evacuation of steam will necessarily give rise to an ebullition of the water in the boiler, and excite to activity the super charge of caloric in the water and steam within, which together with the cause above shown will give an explosive power that no steam boilers can resist: or, in other instances, the motion of the boat may aid or entirely produce the same effect on starting from a state of rest.

Such I conceive to be the cause of the greater part of the accidents that occur on the western waters. To remedy which, I would suggest that at all delays of more than ten or fifteen minutes, the engine should be thrown out of gear with the wheels, and kept in operation till cool; or in case of firing up again, the engine be worked till the boat should be ready to start. By these cautions the danger incident to the stopping of the engine will be obviated, the boilers will have their full supply of water, and the working of the engine will prevent the accumulation of caloric in a latent or inactive state in the water and steam they contain. That heated water will yield more steam when agitated than when at rest is certain, the increased evaporation caused by agitation at all temperature is well known; from which it appears, that caloric may pass into water in a latent form, and be made active again by mechanical means, and no doubt aids much to produce the effects here assigned to it.

There is another kind of explosion more violent and destructive than the above. These occur when the boilers are not supplied with

water, either from the failure of the pumps, or neglect of the engineer. In such cases, the first indication of the mischief is the failure of the engine to perform its work. As the water gets exhausted, the parts of the boiler above its level become heated, beyond what the steam can counteract, and soon will acquire a degree of heat to decompose steam. Here then are two causes counteracting each other: the water converting into steam in a decreasing ratio, and the heated boiler destroying it in an increasing one; from which it is evident there will be a time when the force of the engine will cease, and the water in the boiler no longer held under a pressure from the steam, will rise into foam, so as to come in contact with the whole interior surface of the heated boiler; which, from this contact, will change its temperature from decomposing the water, into that suitable to convert it into the most powerful steam. This change, it will be observed, is not instantaneous, to produce the most violent shock at first; the boiler will require some moments of time to pass through the change, and hence produce the most violent effect even after the breach may be made. This accounts, to my satisfaction at present, for the perplexing things observed in these strange accidents: such as the loss of steam, the breach, and the violent explosions that follow.

The evil to be corrected, on the above suggestions, is no longer to be sought for in the construction of the machines. The danger lies in the combined elements of fire and water, which in some intricate stages will not suffer our control. I have no doubt but the engines in general are, in every respect, suited to their purpose; and if managed with proper care and skill, may be used with the utmost safety; but without these the strongest made engine is as dangerous as the poorer ones. It is to the ignorance and carelessness of those who have charge of engines, that so many melancholy accidents from steam boilers are to be assigned. The greater part of the engineers and officers on board of steam-boats whom I have met with, I have found quite ignorant of the nature of the power they are using. The former generally acquire their responsible profession at the engine factories, or in the duties of firemen. It is not supposed, therefore, that they should be acquainted with the *science* of steam. I have even known those of the highest standing to be entirely ignorant of the principles of the common pump, and unable to correct the bad working of the machine but by repeated trials, during which the greatest mischief may arise. The officers of the boats are but too generally no better informed in the principles of mechanical forces, as well as of fluids, liquid and aeriform, by which all their operations are carried on.

The remedy to the foregoing evils will now suggest itself. The subject of steam and steam engines must be fully explained, and regularly taught, in our institutions and schools of science; and made the subject of lectures and instruction for the benefit of those engaged in it, particularly of those who are to have charge of and to work the engine. And, in fine, a state of things should be brought about, by which those who would wish to follow this profession, should be known by their testimonials to be men of steady habits, and possessing that kind of knowledge which fits them for the trust.

The cause of humanity requires of us to do away with the dangers so unnecessarily put upon our fellow beings, and while our scientific institutions are devoted to the advancement of the most useful instruction, let them all unite and diffuse, generally, that knowledge which is of the utmost importance for the safe and prosperous application of the greatest invention that has ever been made. Let steam be a subject of study and instruction in proportion to its value, and when once a thorough knowledge of it is circulated, we shall find that safety in it which is so much to be desired.

These ideas, if of any value, are humbly inscribed to the Franklin Institute, by G. W. L.

(No. XXI.)

Reply to a circular letter of the committee appointed at a meeting of the Board of Managers of the Franklin Institute, to inquire into the causes of the explosion of the boilers of steam engines.

Louisville, August 8, 1831.

Gentlemen,—Since I became a subscriber to the Journal, I have perused your circular letter inquiring into the causes of the explosions of the boilers of steam engines, and it afforded me much pleasure to see the interest which you have manifested in ascertaining the causes of these melancholy accidents, and devising some plan by which they may be avoided. The numerous explosions which have taken place within the last two years, are alarming, and are almost sufficient to deter a person from travelling in a steam-boat. I am induced to believe, from observation and experience, with yourselves, "that those explosions were produced rather by imperfection in the construction, arrangement, and management of the machinery, than by any inherent and irremediable source of danger in the invention itself." There are now many men engaged and engaging in the engineering business, through the influence of their friends and relatives, who are interested in boats, who are not mechanics of any description; they learn, in a short time, how to start and stop an engine, but know nothing about the first or constituent principles of the machinery, or the construction of it; they know but little about the dangerous properties of steam under some circumstances; they are unable to understand the different effects which occur about an engine; they are ignorant of the pressure which boilers of different sizes and thicknesses are able to sustain; consequently the safety valve is frequently overloaded at the risk of the lives of three or four hundred passengers. It is unquestionably evident, beyond the possibility of doubt, that no man can be capable of doing justice as an engineer who is entirely ignorant, both of the theory and practice of mechanics; (as well might a man attempt the practice of medicine without a knowledge of anatomy;) and so long as men of this kind are employed in boats, so long will accidents occur, in which many valuable individuals will be blown to eternity, leaving in many cases destitute wives and children to lament their untimely death. Humanity calls

aloud for some measure to be taken, to prevent, if possible, these explosions, particularly when we reflect that within the last two years, upwards of one hundred persons, on the Ohio and Mississippi rivers, have fallen victims to the mismanagement of that powerful agent, steam. The subject of explosions is one that has engaged my attention for some time, and I have been collecting all the information I could from some of these accidents, of which I shall proceed to give you an account, agreeably to your request. I have endeavoured to collect the facts as correctly as possible, though in some instances it was difficult to arrive at the truth; for some engineers who were on board at the time of these accidents, and who escaped unhurt, are unwilling to acknowledge that any thing was going wrong at the time of an explosion; so, in some instances, I have relied more upon the information I obtained from passengers. In giving a description of these explosions, I will add my opinion of the causes, according to Mr. Perkins's theory, which I believe to be very applicable.

The boiler of the steam-boat Atlas, which was built for towing vessels, burst on the 1st day of April 1828, at the mouth of the Mississippi. She came to alongside of a vessel to tow it up to New Orleans, and as soon as they had made fast, they rang the bell to go ahead. The first engineer started her, and after she had made two or three revolutions, one of the boiler heads blew out at the after end; the second engineer was the only person killed. The steam may have been higher than the engineer was aware of, but it seems that the principal cause of this accident was that the boiler head was not sound; it was of cast iron, and upon examination they found many small holes in the internal part of the head; and in addition to this, the head was only about one inch thick, which was much too thin.

The Car of Commerce was the next boat the boiler of which burst. *On the 15th of May, 1828,* as she was on her way from New Orleans to *Louisville*, and had got up the Mississippi as far as the Canadian reach, her force pump became heated, and refused to supply the boilers. The engineer stopped her a few minutes to cool down the force pump, and then started her again; but still the pump refused to supply the boilers; they then stopped a second time to examine the pumps, and after a few minutes delay, they started her again, but the engine had not made more than two or three revolutions before the after head of one of her boilers blew out, and killed twenty-six persons, including three engineers. When the head blew out, the reaction of the atmosphere was so great that her boilers, four in number, jumped forward and fell upon the deck. Unfortunately it seems that this boiler head had been cast from the same pattern which had been used for the Atlas. The engineers were apprized of its being cracked previous to the explosion; but, independently of this, there can be no doubt that the water was low in the boilers, as the force pump had failed, and the engineer perhaps neglected to have the fires sufficiently damped, which I know to be frequently the case when an engine is stopped, while under way, to repair something which it is supposed will occasion but a few minutes delay. In the case of

the Car of Commerce, it is generally believed that the water had sunk below the top of the flues in the boilers, which became then exposed to the action of the fire. The steam exposed to the influence of those flues which were most probably red hot, became intensely heated, though of little elastic force; the throttle valve was opened at this time; a discharge of steam followed; the water which before was quiet, being suddenly relieved from the pressure upon its surface, rising up in contact with the heated flues and steam, was instantly converted into vapour, whose elastic force was so great as to produce an explosion.

The boiler of the tow-boat Grampus exploded on the 11th of August, 1828, about eight miles below New Orleans. She was bound up, with two or three vessels in tow at the time when this occurred, which was in the night. The second engineer, who had been placed on watch, had gone to sleep; when he awoke, he found that the water had sunk below the lower gauge cocks, and it is thought that he immediately let on a full supply from the force pump. One person on board noticed his being alarmed when the gauge cocks indicated no sign of water, and shortly afterwards the explosion took place. She had eight double flue boilers, which were all blown overboard, except two pieces of boiler, one about six feet square, and the other about four; besides there were three or four flues remaining on deck, some of which were partly collapsed. Nine persons were killed, including the second engineer; and the damage of the boat was estimated at eight thousand dollars. In this case, the boilers must have been nearly dry, and the flues red hot; and in this situation the engineer it seems let on as much water as the force pump could throw. According to Mr. Perkins's theory, the water, in entering the boiler, was instantaneously flashed into steam of great elasticity, and as the strength of the boilers was much diminished in consequence of their being heated to a very high temperature, it did not require much elastic force to tear them asunder.

A flue of the steam-boat Patriot collapsed in the spring of 1828, near the mouth of the Ohio, on her way from Louisville to New Orleans. The second engineer was on watch, and neglected his business so far as to let the water sink below the flues. In this situation he kept the engine going without having the fires damped, until a flue collapsed and killed two persons. This accident was entirely owing to the sinking of the water below the top of the flue, which was exposed to the fire on the inside, and which, being unprotected by water on the outside, soon became red hot; consequently, its strength was so far diminished that the pressure of the steam, within the boiler, forced its sides together.

One of the boilers of the *Kenhawa Packet* burst on the 27th of June, 1829, at Guyandot, on the Ohio river. In giving a description of this accident, I have relied on the information I obtained from an engineer who was a passenger on board the boat. They landed to put out some passengers, and expected to start again in a few minutes, but were detained above half an hour. The engineer probably thought that the water was flush enough in the boilers, as he did not run the

engine out of gear, which is always done immediately after upon making a landing, in order to keep a supply of water in the boilers. When they shoved out from shore, the engineer found the water had sunk below the gauge cocks, and he appeared to be a little alarmed, as the steam was very high. After they had shoved out from shore, and before they could start, a passenger had to be sent ashore in the yawl, which occasioned further delay, and just as the engineer was going to start the engine, one of her boilers burst and killed eight persons, including the two engineers. I examined this boiler myself; both heads were blown out; they were of cast iron; the flue was separated about the middle, and the forward end of it was thrown overboard; the boiler was torn in a spiral form about half its length, and spread out nearly to a plane surface. This I think was a case similar to that of the Car of Commerce, and especially produced by the opening of the safety valve, which occasioned the water to rise in contact with the heated flues and steam. I know it to be a fact, from experience, that water will rise up in a boiler when the safety valve is opened, for not long since, as I was running an engine, finding that the force pump refused to supply the boilers, I immediately stopped and damped the fire, and upon examination I found that the water had sunk below the lower gauge cocks, which are generally situated about two inches above the flues, in the end of the boiler. By hoisting the safety valve for a few seconds, I found that the water rose up flush with the gauge cocks, and by closing the valve the water again sunk.

A flue of the steam-boat Huntress collapsed on the 11th of April, 1830, near Golconda, on the Ohio river; four persons were killed, including the first engineer, who was on watch at the time. The boat was stopped to send the yawl ashore with a passenger, during which time the engineer blew off steam occasionally, and when the yawl returned, he started the engine, though it did not make more than two or three revolutions before one of the flues collapsed. It was the general opinion on board that the water was low in the boilers; so this accident may be accounted for upon the same principles as that of the Patriot. This accident, and many others of the same kind, might have been prevented if they had stopped in time, and damped the fires; but it is a melancholy fact, that many engineers are ignorant of the rapid evaporation which is going on in boilers when an engine is stopped and the fires burning lively; they are not sensible of the liability to danger under these circumstances.

A boiler of the *steam-boat Caledonia* blew up a few days after that of the Huntress, and killed between twenty and thirty persons. She was on her way from New Orleans to Louisville, and had ascended the Mississippi up to New Madrid. This explosion took place while the boat was under way, and it was immediately reported that every thing was in order at the time, that the water was flush in the boilers, and the steam not very high; but I have conversed with several passengers who were on board, two in particular, who told me they were willing to make oath that they saw the first engineer, who was on watch, try the gauge cocks, and that there was not a particle of water

to be seen, and that the steam was very high; that the engineer appeared to be alarmed, and that they anticipated danger themselves, and left the engine room, but had scarcely got on the upper deck when the boiler burst. It appears that a good deal of mud had collected in her boilers, as the engineers had some trouble for a day or two previous in keeping up a supply of water. The mud from the Mississippi water collects in boilers very fast, and sometimes stops up the connexions between some of the boilers, so that water may be seen flush in some of them, when it is below the gauge cocks in others. I examined the Caledonia's boiler after she was towed up to Cincinnati; it burst near the bottom, close to the forward end, though neither of her heads was blown out. The boiler was torn open about half way around, in the direction of the rivets in some places, and across the sheets in others. This boiler had been repaired a few months before in the very place that gave way, and copper rivets were used instead of iron; this was one of the principal causes of the explosion, for copper will sustain but little more than half the pressure that wrought iron will.

At the place that gave way in this boiler, the iron was burned until it was but little more than an eighth of an inch thick, which was not much more than half its original thickness. When boilers are suffered to get very muddy, the sediment collects in the bottom, until a crust or scale of the carbonate of lime is formed, which soon becomes so hard as to be impenetrable to water; consequently, the boiler will be burned when it is not directly protected by water on the inside. It has frequently happened that holes were burned in boilers by the fireman's accidentally leaving a piece of apron or broom inside when they were cleaning them out; and I have known boilers to be burned until they were scarcely a sixteenth of an inch thick at the bottom, while they retained a thickness of a quarter of an inch at the top; though I do not think this would ever occur with proper attention.

A boiler of the *Helen M'Gregor* burst on the 24th of February, 1830, at Memphis, on the Mississippi, as she was bound up the river. The boat had landed to put out some freight, and just as they had shoved out to go ahead again, one of her boilers burst before the engineer had started her. It is not known how many persons were killed, but somewhere between thirty and forty. It was the after head of one of her boilers that blew out; it was of cast iron, and had been cracked two or three years, and it jumped out of its place from the others about one hundred yards into the river. The principal cause of this accident I suppose was that the boiler head was cracked, a circumstance of which the engineers were apprized, and they ought not to have trusted it; in addition to this, the steam was very high at the time the explosion took place.

A boiler of the *steam-boat Tri-Colour* burst last April at Wheeling, on the Ohio river, and killed thirteen persons, including the captain and second engineer. The first engineer, who escaped unhurt, has given me, I believe, a correct account of this explosion. He states that he was on watch when the boat landed, and that he ran

up the water flush in the boiler, and had the fires damped down before he stopped the engine, as they were going to lie there long enough to make some repairs to the boat. He went into the hold to give a smith directions about making some bolts, and then came out and went to his breakfast, but before he had quite finished, the captain came to the door and observed that the steam was up, and he wished to start. The engineer immediately rose from the table, went out, and found that the steam was very high, and the fires burning lively, and before the bell rung to go ahead, the boiler burst. The captain had ordered the fireman to kindle up the fires, without ever giving the engineer any warning, so that this accident was owing principally to the imprudent conduct of the captain; and it is too often the case that captains interfere when they should not, and affect to know more about the engine, than those who have the management of its mighty power.

This was a low pressure boat, and all the others which I have spoken of were high pressure. The engineer told me he had been blowing off steam just before the boiler burst, and he thinks probably from the length of time which the fires had been burning without his knowledge, that the water had sunk below the flues. There was but one boiler in this boat; it was made after the old plan, with the furnace inside, and the place that gave way was inside of the furnace, directly over the fire grates. This boiler had been in use about ten years, and if many other boilers now in use, nearly of the same age, on the western rivers, could be subjected to the proof which the law requires at present in France, they would be condemned before they occasioned the loss of many lives; and I anticipate with pleasure the arrival of that time, which I hope is not far distant, *when Congress will* take up this subject again, and pay that attention *to it which humanity* calls for.

Four accidents have occurred within the last month, where flues were collapsed, and twelve or thirteen persons killed; and they were entirely owing to negligence or ignorance on the part of the engineer. I could enumerate more of these melancholy accidents, but as I have already transcended the limits of a letter, and probably imposed on your patience, I will desist.

It has been urged by some persons here, who are not acquainted with this subject, that some of these explosions could not have been prevented, because there was an old experienced engineer on board; but it requires no argument to prove that it is not length of time that makes a man more capable; for nature has not endowed every man with the same mechanical ingenuity and intellectual capacity. Many persons are engaged during their lifetime, at some mechanical business and never attain to mediocrity; I know some men who have been engaged for eight or ten years at the engineering business, and who do *not* know near as much about steam and working machinery as some who have not been at it more than three or four years. You have enquired first "What are the probable causes of the explosion of boilers on board of steam-boats?" I have endeavoured to answer this inquiry in giving a description of some of these explosions. You

have inquired in the second place, "What are the best means to obviate the recurrence of these evils, or to diminish the extent of their injurious influence, if they cannot be wholly guarded against?" In answer to this inquiry I would say, in order to prevent these evils, adopt such a plan as the royal ordinance of France prescribes in relation to boilers. Further, cast-iron boiler heads should certainly be prohibited from use, as experience has proved them to be dangerous; and then the most essential thing, is to have a good engineer, for there can be no security in the use of even the strongest and best constructed boiler, if it be left to the management of a man who is ignorant of his duty, or of the strength of the engine. In the third place, you inquire, "By what means can these remedies be applied and enforced?" I shall answer this inquiry by saying, that I believe Congress have it in their power to enforce the means. You have asked for information relative to the boiler, safety valve, supply of water, and so forth. I am not able to give the exact dimensions of the boilers that burst, though I may give them approximatively.

Boilers here are of wrought iron, (none of copper,) made from thirty-two to forty-two inches in diameter, and from three-sixteenths of an inch to one-quarter of an inch thick, some of foreign, and some of American iron; and the difference in the strength of the two is but trifling when they are both well manufactured. The safety valves are from three to five inches in diameter, situated on top of the boilers, loaded with from eighty to one hundred and twenty-five pounds to the square inch; and sometimes considerably more no doubt, as there is scarcely one engineer in twenty that can make a calculation of a safety valve. The generality of boats have but one safety valve, some have two; the Caledonia had four. A safety valve has no more tendency to prevent an explosion under some circumstances, particularly when the water gets low in the boilers, and steam high, than the touch hole of a gun has to prevent the barrel from bursting. When steam gets extremely high, and water low, the safety valve should not be opened, as is so frequently done, instead of damping down the fires. The mode of supplying the boilers with water is with one, and sometimes two, force pumps, which with proper attention I believe to be a good arrangement.

In concluding this letter, permit me to acknowledge my inability to do justice to the subject, and if any thing that I have said should merit your attention, I shall think it an ample recompense for my trouble.

THOS. J. HALDERMAN.

[TO BE CONTINUED.]

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, to ascertain, by experiment, the value of Water as a Moving Power.

(Continued from p. 373, vol. viii.)

TABLE N.—PART I.

CHUTE No. 6.—*Elbow buckets. Close breast. Bottom of gate 3.66 feet above bottom of wheel.*

No. of Exper't.	Head of Water above. Btm. of gate.	Top of Bkt.	Btm. of Bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt. of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	16.59	17.65	18.25	1.00	566	48.95	614.95	41.5	32	12.20	4500	20.75	933750	255204	.273			
2					669	50.58	719.58		37	10.56	5050		1047875	298624	.283			
3					772	52.21	824.21		39	10.02	5775		1198312	342046	.285	.285	10.02	
4					875	53.84	928.84		45	8.71	6700		1390250	385468	.275			
5	16.59	17.65	18.25	1.25	566	48.95	614.95	41.5	26	15.04	4900	20.75	1016750	255204	.250			
6					669	50.58	719.58		28	13.96	5300		1099750	298624	.271			
7					772	52.21	824.21		32	12.20	5750		1193125	342046	.286			
8					875	53.84	928.84		34	11.50	6325		1312437	385468	.293	.293	11.50	
9					978	55.47	1033.47		37	10.56	7025		1457687	428889	.293		10.56	
10					1081	57.10	1138.10		45	8.71	8475		1758562	472310	.267			
11	13.59	14.65	15.25	0.75	416	46.59	462.59	41.5	37	10.56	3730	17.75	662075	191974	.289			
12					463	47.32	510.32		41	9.54	4050		718875	211782	.294	.294	9.54	
13					519	48.21	567.21		47	8.32	4525		803175	235392	.293			
14	13.59	14.65	15.25	1.00	566	48.95	614.95	41.5	34	11.50	4825	17.75	856437	255204	.298			
15					669	50.58	719.58		39	10.02	5425		962937	298624	.300	.300	10.02	
16					772	52.21	824.21		45	8.71	6450		1144875	342046	.298			
17	13.59	14.65	15.25	1.25	669	50.58	719.58	41.5	30	13.02	5675	17.75	1007312	298624	.296			
18					772	52.21	824.21		34	11.50	6200		1100500	342046	.310			
19					875	53.84	928.84		38	10.28	6950		1233625	385468	.312	.312	10.28	
20					978	55.47	1033.47		42	9.31	8350		1482125	428889	.289			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE N.—PART II.

CHUTE NO. 6.—*Elbow buckets. Close breast. Bottom of gate 3.66 feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
21	10.59	11.65	12.25	0.75	360	45.69	405.69	41.5	38	10.28	3725	14.75	549437	168361	.306			
22					416	46.59	462.59		41	9.54	4040		595900	191974	.332	.332	9.54	
23					463	47.32	510.32		46	8.50	4500		663750	211782	.303			
24	10.59	11.65	12.25	1.00	463	47.32	510.32	41.5	34	11.50	4740	14.75	699150	211782	.302			
25					566	48.95	614.95		39	10.02	5280		778800	255204	.328	.328	10.02	
26					669	50.58	719.58		46	8.50	6200		914500	298624	.326			
27	10.59	11.65	12.25	1.25	566	48.95	614.95	41.5	32	12.20	5625	14.75	829687	255204	.307			
28					669	50.58	719.58		37	10.56	6150		907125	298624	.329	.329	10.56	
29					772	52.21	824.21		39	10.02	7050		1039875	342046	.328			
30					875	53.84	928.84		45	8.71	8035		1185262	385468	.325			
31	7.84	8.90	9.50	1.00	463	47.32	510.32	41.5	38	10.28	5175	12.00	621000	211782	.340			
32					566	48.95	614.95		44	8.88	5925		711000	255204	.357	.357	8.88	
33					669	50.58	709.58		56	6.98	7225		867000	298624	.344			Head sunk four inches
34	7.84	8.90	9.50	1.25	463	47.32	510.32	41.5	34	11.50	5625	12.00	675000	211782	.313			
35					566	48.95	614.95		38	10.28	6150		738000	255204	.345	.345	10.28	
36					875	53.84	928.84		57	6.86	9325		1119000	385468	.344			
37					978	55.47	1033.47		65	6.00	10800		1296000	428889	.330			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table N.—Part III.

Chute No. 6.—*Elbow buckets. Close breast. Bottom of gate* 3.66 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
38	4.34	5.40	6.00	1.50	566	48.95	614.95	41.5	44	8.88	7625	8.00	610000	255204	.418			
39					669	50.58	719.58		50	7.82	8750		700000	298624	.426	.426	7.82	
40					772	52.21	824.21		58	6.73	10100		808000	342046	.419			
41	4.34	5.40	6.00	1.75	566	48.95	614.95	41.5	40	9.77	7425	8.00	594000	255204	.429			
42					669	50.58	719.58		45	8.71	8290		663200	298624	.450	.450	8.71	
43					725	51.45	776.45		49	7.98	8975		718000	322226	.448			
44					772	52.21	824.21		52	7.52	9525		762000	342046	.448			
45					828	53.02	881.02		55	7.10	10325		826000	365623	.442			
46	1.00	2.06	2.66	1.50	360	46.61	406.61	41.5	63	6.20	6760	4.66	315692	168743	.531			
47					416	47.62	463.62		75	4.30	7500		350250	192402	.548	.548	4.30	
48					463	48.48	511.48		79	4.95	8370		390879	212264	.541			
49	1.00	2.06	2.66	1.75	360	46.61	406.61	41.5	61	6.40	6750	4.66	315225	168743	.531			
50					463	48.48	511.48		73	5.35	8160		381072	212264	.555	.555	5.35	
51					519	49.31	568.31		81	4.83	9100		424970	235847	.553			
52					566	50.35	616.35		89	4.40	9925		463497	255785	.554			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table O.—Part I.

Chute No. 6.—*Centre buckets. Close breast. Bottom of gate 3.66 feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of ate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	19.34	20.40	20.40	1.00	463	47.32	510.32	41.5	33	11.84	3930	23.00	903900	211782	.233			
2					566	48.95	614.95		36	10.86	4450		1023500	255204	.249			
3					669	50.58	719.58		40	9.77	5150		1184500	298624	.252	.252	9.97	
4	19.34	20.40	20.40	1.25	463	47.32	510.32	41.5	25	15.64	4425	23.00	1017750	211782	.207			
5					566	48.95	614.95		27	14.48	4700		1081000	255204	.236			
6					669	50.58	719.58		30	13.00	5250		1207500	298624	.247			
7					772	52.21	824.21		34	11.50	5850		1345500	342046	.254	.254	11.50	
8					875	53.84	928.84		42	9.31	7000		1610000	385468	.239			
9	16.59	17.65	17.65	0.75	360	45.69	405.69	41.5	37	10.56	3225	20.75	669187	168361	.251			
10					463	47.32	510.32		49	7.98	3950		819625	211782	.254			
11					566	48.95	614.95		60	6.50	5250		931875	255204	.273	.273	6.50	
12	16.59	17.65	17.65	1.00	360	45.69	405.69	41.5	25	15.64	3675	20.75	762562	168361	.223			
13					463	47.32	510.32		29	13.48	4050		840375	211782	.252			
14					566	48.95	614.95		33	11.84	4550		944125	255204	.270			
15					669	50.58	719.58		37	10.56	5175		1073812	298624	.278	.278	10.56	
16					772	52.21	824.21		43	9.09	6050		1255375	342046	.272			
17					875	53.84	928.84		54	7.24	7625		1582187	385468	.243			
18	16.59	17.65	17.65	1.25	772	52.21	824.21	41.5	32	12.20	6050	20.75	1255375	342046	.272			
19					875	53.84	928.84		36	10.86	6750		1400625	385468	.275	.275	10.86	
20					978	55.47	1033.47		42	9.31	7950		1649625	428889	.259			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table O.—Part II.

Chute No. 6.—*Centre buckets. Close breast. Bottom of gate* 3.66 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
21	13.59	14.65	14.65	0.75	257	44.06	301.06	41.5	30	13.00	2960	17.75	514750	124940	.242			
22					360	45.69	405.69		36	10.86	3430		608825	168361	.276			
23					463	47.32	510.32		43	9.09	4130		733075	211782	.288	.288	9.09	
24					566	48.95	614.95		55	7.10	5175		918562	255204	.277			
25	13.59	14.65	14.65	1.00	463	47.32	510.32	41.5	30	13.00	4410	17.75	782775	211782	.270			
26					566	48.95	614.95		33	11.84	4900		869750	255204	.293			
27					669	50.58	719.58		38	10.28	5525		980687	298624	.304	.304	10.28	
28					772	52.21	824.21		44	8.88	6450		1144875	342046	.298			
29	10.59	11.65	11.65	1.00	360	45.69	405.69	41.5	30	13.00	4150	14.75	612175	168361	.275			
30					463	47.32	510.32		34	11.50	4780		705050	211782	.300			
31					566	48.95	614.95		37	10.56	5325		785437	255204	.325			
32					669	50.58	719.58		43	9.09	6175		910812	298624	.327	.327	9.09	
33					772	52.21	824.21		56	6.98	8100		1194750	342046	.287			
34	10.59	11.65	11.65	1.25	669	50.58	719.58	41.5	34	11.50	6650	14.75	980875	298624	.304			
35					772	52.21	824.21		40	9.77	7325		1080437	342046	.316	.316	9.77	
36					875	53.84	928.84		45	8.70	8675		1279562	385468	.301			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table O.—Part III.

Chute No. 6.—*Centre buckets. Close breast. Bottom of gate 3.66 feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	* Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
37	8.34	9.40	9.40	1.00	360	45.69	405.69	41.5	35	11.16	4575	12.00	549000	168361	.306			
38					463	47.32	510.32		39	10.02	5170		620400	211782	.341			
39					566	48.95	614.95		45	8.70	6090		730800	255204	.349	.349	8.70	
40	8.34	9.40	9.40	1.25	463	47.32	510.32	41.5	33	11.84	5875	12.00	705000	211782	.300			
41					566	48.95	614.95		37	10.56	6450		774000	255204	.329			
42					669	50.58	719.58		41	9.54	7300		876000	298624	.340	.340	9.54	
43					772	52.21	824.21		50	7.82	9330		1119600	342046	.305			
44	8.34	9.40	9.40	1.50	669	50.58	719.58	41.5	37	10.56	7790	12.00	934800	298624	.319			
45					772	52.21	824.21		41	9.54	8800		1056000	342046	.323	.323	9.54	
46					875	53.84	928.84		47	8.32	10000		1200000	385468	.321			
47					978	55.47	1033.47		58	6.74	13200		1584000	429889	.270			
48	4.34	5.40	5.40	1.50	463	47.32	510.32	41.5	41	9.54	7070	8.00	565600	211782	.375			
49					566	48.95	614.95		47	8.32	8075		646000	255204	.394			
50					669	50.58	719.58		54	7.24	9370		749600	298624	.398	.398	7.24	
51					772	52.21	824.21		72	5.43	11575		926000	342046	.383			
52	4.34	5.40	5.40	1.75	566	48.95	614.95	41.5	42	9.31	7775	8.00	622000	255204	.410			
53					669	50.58	719.58		48	8.14	8990		719200	298624	.414	.414	8.14	
54					772	52.21	824.21		60	6.50	10825		866000	342046	.399			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE O.—PART IV.

CHUTE No. 6.—*Centre buckets. Close breast. Bottom of gate 3.66 feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Secds.	Feet.	Pds.	Feet.						
55	4.34	5.40	5.40	2.00	566	48.95	614.95	41.5	41	9.53	7710	8.00	616800	255204	.413			
56					669	50.58	719.58		46	8.50	8800		704000	298624	.424	.424	8.50	
57					772	52.21	824.21		58	6.74	10750		860000	342046	.397			
58	1.00	2.06	2.06	1.50	257	44.74	301.74	41.5	60	6.50	5850	4.66	273195	125229	.458			
59					360	46.61	406.61		72	5.43	7225		337407	168743	.500			
60					463	48.48	511.48		90	4.35	8800		410960	212264	.521	.521	4.35	
61					566	50.35	616.35		108	3.62	10925		510197	255785	.501			
62	1.00	2.06	2.06	1.75	463	48.48	511.48	41.5	81	4.83	8625	4.66	402787	212264	.526			
63					566	50.35	616.32		96	4.07	10325		482177	255785	.530	.530	4.07	
64					669	52.22	721.22		123	3.18	12675		591922	299306	.505			
65	1.00	2.06	2.06	2.00	360	46.61	406.61	41.5	64	6.10	7025	4.66	328067	168743	.514			
66					463	48.48	511.48		77	5.07	8560		399752	212264	.530			
67					566	50.35	616.32		93	4.20	10260		479142	255785	.533	.533	4.20	
68					669	52.22	721.22		120	3.25	12525		584917	299306	.511			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table P.

Chute No. 6.—*Centre buckets. Inclined above the shaft. Bottom of gate 3.66 feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	19.34	20.40	20.40	1.25	566	48.95	614.95	41.5	31	12.60	4300	23.00	989000	255204	.257			
2					669	50.58	719.58		35	11.16	4825		1109750	298624	.269	.269	11.16	
3					772	52.21	824.21		40	9.77	5650		1299500	342046	.266			The position of this bucket is such that a line parallel to its face, when extended, will pass $15\frac{1}{3}$ inches above the centre of the shaft.
4	13.59	14.65	14.65	1.25	669	50.58	719.58	41.5	31	12.60	5780	17.75	1025950	298624	.291			
5					772	52.21	824.21		36	10.86	6320		1121800	342046	.304	.304	10.86	
6					875	53.84	928.84		41	9.54	7150		1269125	385468	.303			
7	8.34	9.40	9.40	1.00	360	45.69	405.69	41.5	38	10.28	4425	12.00	531000	168361	.316			
8					416	46.59	462.59		45	8.71	4600		552000	191974	.347	.347	8.71	
9					463	47.32	510.32		52	7.52	5100		612000	211782	.345			
10					556	48.95	614.95		67	5.84	6475		777000	255204	.327			
11	8.34	9.40	9.40	1.25	566	48.95	614.95	41.5	39	10.02	6260	12.00	751200	255204	.339			
12					622	50.10	672.10		41	9.54	6650		798000	278921	.348	.348	9.54	
13					669	50.58	719.58		45	8.71	7250		870000	298624	.343			
14	4.34	5.40	5.40	1.75	566	48.95	614.95	41.5	42	9.31	7500	8.00	600000	255204	.425			
15					622	50.10	672.10		43	9.09	7950		636000	278921	.439	439	9.09	
16					669	50.58	719.58		47	8.32	8600		688000	298624	.434			
17	1.00	2.06	2.06	1.75	360	46.61	406.61	41.5	63	6.20	6750	4.66	315225	168743	.534			
18					416	47.62	463.62		70	5.58	7525		351417	192402	.546	.546	5.58	
19					463	48.48	511.48		79	4.95	8350		389945	212264	.542			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table Q.

Chute No. 6.—*Centre buckets. Inclined below the shaft. Bottom of gate* 3.66 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	19.34	20.40	20.40	1.25	566	48.95	614.95	41.5	29	13.48	4350	23.00	1000500	255204	.255			The position of this bucket is such that a line parallel to its face, when extended, will pass 15½ inches below the centre of the shaft.
2					669	50.58	719.58		30	13.00	4875		1121250	298624	.266			
3					772	52.21	824.21		35	11.16	5475		1259250	342046	.271	.271	11.16	
4	13.59	14.65	14.65	1.25	669	50.58	719.58	41.5	32	12.20	5700	17.75	1011750	298624	.295			
5					772	52.21	824.21		36	10.86	6325		1122687	342046	.304	.304	10.86	
6					875	53.84	928.84		40	9.77	7175		1273562	385468	.302			
7	8.34	9.40	9.40	1.25	566	48.95	614.95	41.5	39	10.02	6370	12.00	764400	255204	.334			
8					622	50.10	672.10		42	9.31	6700		804000	278921	.346	.346	9.31	
9					669	50.58	779.58		45	8.71	7175		861000	298624	.344			
10	4.34	5.40	5.40	1.75	566	48.95	614.95	41.5	43	9.09	7550	8.00	604000	255204	.422			
11					622	50.10	672.10		45	8.71	7975		638000	278921	.437	.437	8.71	
12					669	50.58	719.58		50	7.82	8700		696000	298624	.427			
13	1.00	2.06	2.06	1.75	360	46.61	406.61	41.5	64	6.10	6760	4.66	315692	168743	.532			
14					416	47.62	463.62		71	5.50	7525		351417	192402	.575	.575	5.50	
15					463	48.48	511.48		79	4.95	8360		390412	212264	.542			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

[TO BE CONTINUED.]

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JULY, 1831.

With Remarks and Exemplifications, by the Editor.

1. For improved *Cushions for Billiard Tables;* Abraham Bassford, city of New York, July 20.

Gum elastic, or India rubber, is to be cut into pieces of about an inch square. These are to be fastened to the cushion rail with glue or cement. Great care must be taken that the faces of the pieces are made with perfect truth. The India rubber is afterwards to be covered with leather, webbing, and green cloth. The claim is to the gum elastic stuffing for the cushions of billiard tables.

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2. For bending *Iron Hoops to be applied to the bottoms of Card and Drawing Cans;* John Butterworth, Philadelphia county, Pennsylvania, July 20.

To preserve the tin cans used with carding and spinning machines, their bottoms are to be furnished with iron hoops, the lower edges of which are to be bent inwards so as to form a flanch for sustaining the bottoms of the cans. It is proposed sometimes to tin these hoops, and to attach them to the can by soldering.

To bend the iron hoops they are to be slipped over round blocks of cast iron, of the proper size. The lower edge of the hoop rests upon a shoulder, and its upper edge stands above the block, over which it is to be bent, either when heated or cold.

The invention claimed is the machine for bending the hoops, and also the soldering them upon the cans.

This mode of bending metallic hoops is so obvious and so common that the only marvel about it is that any one should think of taking a patent for it.

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3. For a *Thrashing Machine;* John Vasburg, Kinderhook, Columbia county, New York, July 20.

The patentee tells how his machine is made, and what it will do, and that it may be worked by horse or other power. The whole story has been so frequently told, that to repeat it would be mere prosing, a thing which we do not admire either in ourselves or others. We read of revolving beaters, an apron, and a concave, but they, fortunately, are not introduced as new, no claim being made.

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4. For an improvement in the mode of making *Steam Engine Boilers,* called the 'safety steam boiler;' John C. Douglass, city of New York, July 20.

We gave at p. 226, vol. vii. the specification of a patent for a steam engine boiler, which issued to the same gentleman on the 17th day of December, 1830. The present boiler is constructed under the same theoretical views with his former; views which are at variance with all the well established principles of natural philosophy,

and which therefore have led the patentee wide of the goal at which it was his hope to arrive.

We are told that the improvement now offered "is founded on the discovery, that very many, if not all, the explosions of steam boilers arise from the fact that a highly rarified state of steam, or a vacuum, exists *within* the boiler, at the bottom and lower parts of the boiler." The *mode* in which this vacuum is supposed to be formed is the removal *of* pressure in the boiler by the opening of the safety valve, or *from* any other cause. The steam and foam then ascending to the *top*, leaving a void space below, the consequence of which will be a collapse of the boiler.

In order to fill up this vacuous space, tubes are to lead into the lower part of the boiler, and to be bent up at the outside to the height at which the water in the boiler is intended to stand. The upper ends of these tubes are to be furnished with valves, which open inwards, so that when there is a vacuum formed in the boiler, the valves may open, and admit either air, or water, as may be desired.

This certainly is the most powerful, and at the same time the most capricious vacuum of which we have ever heard; for whilst it sustains the whole load of water, and the pressure of steam in the boiler, it refuses to keep a valve closed which opens inwards to supply the boiler with air or water.

We perceive but little difference in the assumption and principle, or rather absence of principle, upon which the two patents taken out by this gentleman are founded.

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5. For an improvement in the *Manner of Drawing Soda Water;* Ambrose Church, Canandaigua, Ontario county, New York, July 20.

If the security of a patent depends upon the number of persons who *obtain* it under the character of being the true and original inventors, the present is perfectly safe, as it has now no fewer than five guardians; see p. 166, 247, and 340, vol. viii. and the next article with the remarks there made. The present patentee says that "the patent is not taken for the composition of the ingredients, but for the mode of drawing the water," which is exactly like those referred to. Water, and the proper ingredients for making soda water, are to be placed in two jars. Now although we know something about soda water, we could not tell what ingredients to put into two jars, which by their union would produce it. We are led to the conclusion, therefore, that it is not soda water, but the common effervescing mixture of the physician, which is to be formed.

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6. For an improvement in the *Soda Fountain;* Noah H. Coleman, Mentz, Cayuga county, New York, July 20.

"*Another*, and another, and another."

We are here told what ingredients the patentee intends to use, as, into one *jar he* puts a gallon of ice water, with eight ounces of super-

carbonate of soda, and into another seven ounces of tartaric acid, with the water.

Besides these two jars, there may be another containing mead, or "any other liquid" which may adapt the whole to the palates of those who wish for something good.

The apparatus here described is more complex than those of the other patentees, but the design is the same.

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7. For a *Cooking Stove;* Elisha Bates, and David Updegraff, Mount Pleasant, Jefferson county, Ohio, July 20.

This cooking stove has boilers passing through holes in the top, and others with tubes passing through openings in the side; it has also an oven, and various other usual appendages. These are all described at great length in the specification, but there is no attempt in it to point out any thing really new. We have no doubt that when properly managed, it will be a good stove, though not superior to many others.

If a patent can be sustained upon such a specification, it must be upon the particular arrangement exactly as described, for whatever of novelty it may present consists in this.

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8. For *Machinery for Manufacturing Tin Ware;* Edward M. Converse, Southington, Hartford county, Connecticut, July 20.

Those acquainted with the progress made within the last thirty years in the manufacturing of tin ware, know, that with the exception of soldering the work together, nearly the whole of the labour is performed by machinery.

The present patentee has described and figured machinery for turning straight edges—for grooving—for double seaming—for setting down bottoms on vessels—for turning edges for wiring, and for burring.

In their general construction these machines resemble those heretofore known, but with certain alterations which the patentee believes to be improvements; and the whole description of which occupies more than twenty-four pages. He says that they are cheaper, more durable, and perform the work better than any others.

The frame work of his machinery, the wheels, boxes, and most other parts, are made of a compound of zinc, copper, and tin, in the proportion of ten parts of the first, one of the second, and half a part of the third. He mixes these by melting together the copper and tin, to which he adds as much zinc as the weight of both. This mixture is then combined with the remainder of the zinc, in a fused state.

This metal, we are told, is valuable for making a great variety of articles in domestic economy; that it is recommended by its cheapness, and freedom from corrosion, and that it receives a fine polish. The patentee, although he inserts the recipe, does not, we suppose, intend to claim this particular composition as making a part of his patent, as it is a kind of mixture well known in the manufactories of Europe, and in many of our own. He has not, in fact, inserted any claim to it.

9. For an improvement in the *Making of Pasteboard or other Paper*; Frederick A. Taft, Dedham, Norfolk county, Massachusetts, July 20.

The pasteboard, or paper, alluded to, is, we suppose, intended for sheathing, as it is to be saturated with pitch or rosin; and it is the new mode of doing this which forms the subject of the present patent. The pitch, or rosin, is to be finely powdered, and mixed with the pulp of which the paper is to be made. The paper, after being dried, is heated, and passed between hot rollers, which renders it compact.

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10. For a machine for *Excavating and Removing Earth*, called the 'excavator and self-loading machine;' Menoah Alder, and William F. Boyd, Northumberland, Northumberland county, Pennsylvania, July 20.

(See specification.)

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11. For an improvement in the *Grist Mill;* Jehiel W. Dart, Willard Webster, and Hiram Webster, Truxton, Courtland county, New York, July 20.

A suitable frame is made to support the stones, and their gearing. The stones may be about sixteen inches in diameter. The upper stone is stationary, being bolted upon the framing, the lower stone is convex, to adapt it to the upper one. The spindle upon which the runner is fixed, has a step below, and passes through the cap stone into a box above.

"The invention hereby claimed, is the cheapness of the construction of the mill, the grinding surface as before described, and lessening the usual power for grinding."

Cheapness is a very acceptable quality, but, we think, scarcely patentable. Convex and conical surfaces have been before used in such mills, and why the power required for grinding will be less in this than in other mills of the same size, we do not see, and are not told. The difference between this and several other portable grist-mills is so trifling that we are at a loss how to divide the merit of the invention among the three patentees. Using all the light which the claim throws upon this subject, we are led to the conclusion that one of them may have invented the "cheapness," another the "grinding surface," and the third the "lessening the usual power for grinding."

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12. For *Machinery for Cutting Leather, or other substances, into any desired shape, at one operation;* George Domitt, city of Boston, July 20.

The cutting part of this machinery consists of a knife bent into the form of the article to be cut, as the visor of a cap, or the upper leather of a shoe, and fastened to a stock of cast iron, or other suitable material. It is to be forced down by a lever, or any other suitable power.

So far there is no novelty in the invention, as a patent was taken

for such knives, or cutters, about sixteen, and again about three, years ago. The present patentee, however, uses a clearer, or clearers, to force the leather out, after it has been cut; for this purpose there are two bolts which slide freely through the stock to which the knives are fixed. These bolts are borne up by spiral springs so as, ordinarily, to stand flush with the inside of the stock; when forced down, these will push the leather clear of the knives. They may be forced down by causing them to touch against a piese fixed for that purpose, as the lever rises after the cutting.

The claim made is, not to any of the separate parts, but to the combination of the whole. As the main principle, however, that of the knives, or cutters, is not new, the particular arrangement here described may be easily so varied as not to interfere with such a claim.

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13. For improvements in the construction of *Candle Moulds;* Timothy J. Dyre, and Anthony Richmond, New Bedford, Bristol county, Massachusetts, July 20.

These moulds are made and fixed in a frame in the usual way, but the lower ends, or tips, of the moulds are to be made of brass, or other hard metal. The upper plate also, upon which the tallow is poured, is formed of hard metal, and the block tin moulds are soldered to it. One side of the frame, which forms the trough round the moulds, is made to slide down, to facilitate the removal of the superfluous tallow. The improvements claimed are the hard metal tips, and the metal plate which receives the upper ends of the moulds.

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14. For machines for *Drilling or Boring Holes horizontally, or vertically, in stone, iron, or wood;* Ebenezer C. Everts, Greene, Chenango county, and William Lockwood, Colesville, Broome county, New York, July 20.

There is to be a sliding frame which works up and down vertically, in grooves. A vertical shaft, with a drill at its lower end, is affixed to this frame, as is also a crown wheel which takes into a pinion on the shank of the drill. The sliding frame is to be drawn down with any desired force, by weights acting upon pulleys. This machine, we are told, may be placed horizontally or otherwise. The substance to be drilled, or bored, is to stand beneath the frame, and when the crown wheel is turned by means of a crank, the article will be drilled.

If it is intended to drill soap stone, such a machine may do well enough, but if sandstone, granite, or any of the hard stones usually employed, are treated in this way, they will refuse to yield, and will grind the steel more rapidly than the latter will cut them. Those persons who have seen stone drilled, know that there is nothing in this process resembling ordinary drilling, as it is performed by repeated blows from a cutting edge, formed like a chisel. We have described more than one machine for this purpose, in which the pro-

per motion was given to the drill by the apparatus, instead of the usual way of working it by hand.

15. For *Composition Paint;* Philip A. Klipstine, New Baltimore, Fauquier county, Virginia, July 20.

This composition paint is to be made by pouring one gallon of boiling water upon one pound of quick lime, and two ounces of sugar of lead. When the lime has become completely slaked, the mixture is to be stirred, and it is then fit for use. It may be made with less water if required thicker, and colouring ingredients may be added to it, and with them an additional portion of the sugar of lead. It is said, that the cost is about one-thirteenth of that of oil paint, and that it is nearly equal to it in beauty. When exposed to the weather, it ought to be secured by a coat of oil.

16. For a mode of *Manufacturing White Lead;* George A. Harrison, of the city of New York, July 20.

It is the request of the patentee that his specification should not be published at present.

17. For a *Thrashing Machine;* Philip Harrington, Petersburg, Dinwiddie county, Virginia, July 20.

There are to be square iron spikes driven into a cylinder so as to stand out one or two inches, "in such a position that they may lean from a perpendicular line falling upon the centre of the cylinder, towards the front part of the machine." This oblique position of the teeth, we are told, causes the machine to operate with much greater ease than it would otherwise do. The spikes are to form spiral rows round the cylinder, and the spikes of the concave are to be precisely similar to those of the cylinder; but there are to be bars, or plates, of iron placed between the staves of which the concave is formed, and projecting inwards so that their edges stand within from one-eighth to one-fourth of an inch of the spikes on the cylinder.

The claims are to the position of the spikes on the cylinder and concave; to the manner of distributing the spikes; and to the thin bars or plates of iron.

Sloping teeth have been before used. Strips of iron have been made to alternate with the teeth of the cylinder, if not of the concave; and the distribution of the teeth does not appear to offer any thing new.

18. For a *Thrashing Machine;* Ira Crawford, Sweden, Monroe county, New York, July 20.

Another cylinder and concave machine, here presents itself. Iron bars, with teeth, are to extend from head to head of the cylinder, and are to stand obliquely. Whatever there is of novelty in all this belongs to the patentee, the rest to the public.

19. For *Percussion Locks, and Walking Cane Rifles and*

Pistols; Alvin D. Cushing, city of Troy, Rensellaer county, New York, July 20.

The percussion lock here described is intended principally to be used in walking sticks, the barrel forming the lower part of the stick. The hammer, which is to be borne up by a spiral spring, strikes in the middle of the breech pin. The particular arrangements are very distinctly exhibited by the patentee, but need not be described here. He says that he believes "the whole principle and manner of operation, as applied to percussion, or any other locks, is new, except the mode of discharging it by force of the spiral spring." This may be the case, but a very neat and compact instrument of this kind was made some four or five years since by Mr. Saxton, in Philadelphia, and percussion gun walking canes have been made and patented in England. The whole thing is a matter of curiosity rather than of utility, and ingenuity may devise various plans for arranging the parts, without adding any thing to the stock of instruments of value.

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20. For an improved *Truss for Hernia,* called the "Gum Elastic Truss;" John J. Heitzleman, M. D., city of Philadelphia, July 20.

The principal improvement here claimed is the forming of the pad of gum elastic, without employing any covering; thereby promoting cleanliness, as this material is not absorbent, and is therefore kept clean with perfect ease. The strap which goes round the body is furnished with spiral wire springs, and there is some novelty in the adjustment of the metallic plate of the pad to the steel spring. This, however, has already been so varied, that much improvement is not to be expected.

Judging from the matter before us, we have no doubt that this truss is altogether a good one.

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21. For making *Lamps of various descriptions and forms out of Wood;* Joseph H. Mather, Saybrook, Middlesex county, Connecticut, July 20.

The drawing and model of this lamp, represent one of the ordinary form, turned entirely out of wood. The only metallic part about it is the plate and tubes through which the wick passes. The cavity, or chamber for oil is to be coated with glue, white lead, varnish, or some other material which will resist the oil, or other fluid to be burnt.

The claim is to the application and use of wood in the construction or manufacture of lamps.

Such lamps will undoubtedly answer the intention very well, as the heat from the wick will never affect the wood injuriously; and when persons become tired of burning oil in them, they will serve to aid in kindling their fires.

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22. For *Propelling Boats by Man Power;* Alexander Renoir, New Orleans, Louisiana, July 20.

This is the age of great mechanical inventions. Watt and his

successors have applied the power of steam in such a way as to produce the most magnificent results; but it was reserved for the present patentee to discover that if they had understood the proper use of their arms and legs, and had known how to make them operate through the medium of levers, wheels, and pinions, as arranged by him, they might have saved themselves no small wear and tear of brains, have propelled boats against the current without danger of explosions, and without the employment of other fuel than bread and cheese.

One man is to propel the boat as well as to steer it; the former he is to effect by his feet, the latter by his hands. The boat too, if we judge from the drawing, will be no plaything.

There are two treadles near the bows of the boat, upon which a man, (Hercules probably,) is to place his feet, whilst his hands manage two tillers, with their ropes, which extend to the rudder in the stern. The two treadles work two pitmen, or shackle bars, which extend back to two cranks, standing in reversed directions on a shaft which crosses the boat, and extends out to the outer timber of the wheel frame. Upon each end of this shaft there is a fly wheel, and a pinion that appears to have on it about sixteen teeth, which take into cog wheels of, apparently, about six times their own diameter. These cog wheels are also the paddle wheels of the boat, as buckets, or paddles, project out from each side of them, and act upon the water.

The reader is now in possession of the whole contrivance, and the commonest mechanician will perceive that although the man at the treadles may be compelled to blow off his steam, the boat will obstinately resist all his efforts, notwithstanding the *aid* of the fly wheels. His crank shaft must perform six revolutions whilst the paddle wheel turns but once. Should the patentee attempt the voyage from New Orleans to St. Louis, we advise his friends to keep a good look out for him at the Balize. The time of his arrival may be pretty accurately calculated by the passage of drift wood down the Mississippi.

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23. For a *Cooking Stove;* Thomas Woolson, Claremont, Sullivan county, New Hampshire, July 20.

The form of this stove is such as to give it the appearance of two ordinary cooking stoves joined together. One of these parts constitutes the fire place, the other the oven, and surrounding flues; the back plate of the fire place forming one side of the oven.

The claims made are the placing the two parts of the stove, horizontally, side by side; the mode of turning the blaze and smoke round the oven; the arrangement of dampers, by which the blaze may be admitted into the funnel without passing round the oven; and the method described in the specification, of making the fire place in one, or dividing it into two parts, by a moveable plate.

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24. For *Manufacturing Rollers of Cast Iron;* James Wood, city of Philadelphia, July 20.

(See specification.)

25. For *Manufacturing Potash from Wood Ashes;* Ephraim Pearce, Lincklaen, Chenango county, New York, July 20.

Leaches are to be prepared by placing sticks, straw, and quick-lime, in the usual manner. They are not to contain more than six bushels of ashes, which must form a stratum of from eight to fourteen inches in thickness. Forty-five gallons of water, containing six pounds of salt, are to be heated to near the boiling point, and half a bushel of unslaked lime is then to be thrown in, which will immediately produce boiling. A bushel of ashes is to be boiled in another kettle with six gallons of water. A bushel of ashes is then to be put into the leach, and upon this three gallons of the boiling lime water are to be poured and allowed to soak in. Ashes are then to be added, a bushel at a time, with six gallons of the lime water after each, until the intended six bushels are in the leach. The remaining lime water is to be poured on, six gallons at a time, allowing it to disappear between each pouring.

Three gallons of cold water are then to be put into the kettle of boiling ashes and water, when a quart or two of slaked lime, and a pint, or less, of salt, are to be sprinkled on; after removing the coals, &c. by skimming, six gallons of this water are to be put into the ley kettle. The remainder, with the ashes, is to be put into the leach; cold water is afterwards to be poured on the leach until the strength is out. This leached liquid is to be put into the ley kettle containing the above named six gallons, and the boiling is then to be effected in the ordinary way; which, the patentee says, will at once produce the best quality of potash. He adds, that ashes, which, worked by the ordinary process, will produce one ton, will, by his method, yield *more than two tons.*

We have been at some pains to give the whole process by which the patentee says he produces a result so extraordinary, as we are altogether unable to discover in it any thing to justify the assertion; nor are we prepared to believe that manufacturers of potash have hitherto been in the habit of throwing away more than one-half of that which is contained in the wood ashes.

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26. For an improvement in the *Fly Net for Horses;* Peter Mintzer, city of Philadelphia, July 20.

The patent granted to Henry Korn, of Philadelphia, (see vol. iv. p. 409,) is noticed, and the description of his net inserted in the present specification.* The improvements claimed by the present patentee, is the using net work, and tasselling of silk, or other braid, instead of the parts which form the longitudinal straps in the former. The net so made, is said to be lighter and more convenient in use, as well as much handsomer. The difference, however, is very trifling.

There is no drawing of this fly net, but a "specimen deposited in the patent office," is referred to; we apprehend that the specimen might be exhibited in a drawing; and therefore that it ought to have been done, as the law expressly requires a "drawing with written references, whenever the nature of the case *admits* of drawings."

27. For a machine for *Cleaning Grain from Dirt;* Thomas Reese, Jones' Falls, near Baltimore, Baltimore county, Maryland, July 20.

This machine consists, mainly, of a hopper, and rubbing plates, formed of sheet iron, to which motion is given by a crank. The lower rubber forms a plane a little inclined from the hopper, and is similar to the upper one, with the exception of being stationary. We are told in the specification, that the rubbers "are made by punching grooves and ridges in sheet iron, about half an inch deep, eighteen inches wide, and seven feet long, and fastening them on boards." As this description does not appear to us to be very luminous, we have given the exact words.

The claim is to "the before described machine for cleaning grain from all kinds of dirt."

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28. For a *Plough;* Barnabas Thacher, jr. Barnstable, Barnstable county, Massachusetts, July 20.

This plough is to be made upon any known principle; but the beam is to be rendered capable of having its direction altered, either upwards, downwards, or laterally, by means of screws, wedges, or otherwise. The claim is to the making a plough capable of this alteration.

The scratch of a pen, which, under the name of a drawing, accompanies the specification, lends but little aid to the description; the object, however, can be understood without it. We have, more than once, seen the farmer alter the set of his plough on the beam, by means of screws or wedges; but hereafter this will, of course, be forbidden by the present patentee.

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29. For a machine for *Dressing Staves and Heading, and for Jointing;* John B. Tackels, Pomfret, Chatauque county, New York, July 20.

This may possibly be a very good machine, but as the specification, with the aid of the drawing, does not enable us to understand its particular structure, we must pass it by until we receive more light upon the subject. There are to be revolving cutters, fixed somehow, and jointers operating someway, to leave the stave with its required bulge. No claim is made.

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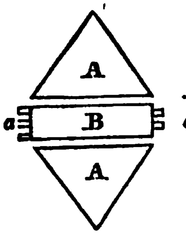
30. For an *Easy Motion and Pavement Saving Wheel,* for Carriages of all descriptions; Felix Varela, of the city of New York, July 20.

We have heard of fortifying a city with leather, and the present invention takes one step towards the carrying this plan into execution, as our pavements are to be defended against the martial attacks to which they have hitherto been subjected by the hard tyre which has surrounded them. Every wheel, hereafter, is to carry with it, *a leather rail road,* altogether novel in its construction, and unique in its appearance.

In the first place the wheel is to be put together without iron tyre,



but is to be closely embraced by a double strap of leather. A number of wooden boxes, or rattle-traps, are then to be prepared, by taking two triangular pieces, A A, and one rectangular piece B, equal in width to the thickness of the wheel. Upon the edges of this piece are to be nailed, or screwed, the triangular pieces, which triangular pieces will then stand parallel to each other. These wooden boxes are to be hinged together, at *a*, *a*, so as to form a chain considerably longer than the circumference of the wheel; but not sufficiently so to allow the angles of the boxes to leave the rim of the wheel. Leather is to be nailed upon each of the rectangular pieces B, which surround the wheel, and a continued or endless strap, is to be affixed within the whole of them, by small straps attached to the iron hinges. When one of these is put round each wheel, the system is ready to operate.

The chain of triangular boxes being somewhat larger than the wheel, allows, according to the drawing, two of them to lie flat upon the pavement.

We assure the reader that we are not joking, but have given as honest and exact a description of this truly astonishing contrivance, as we are capable of doing. Should the patentee make a public trial of his invention in the city of New York, he will attract a degree of attention, and acquire an amount of notoriety, which few beside will obtain. As muddy streets are unfavourable to such a concern, we hope the corporation of that metropolis will allow the scavengers to take the lead in the procession.

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31. For a *Machine for Cutting Paper;* Edward Pine, city of Troy, Rensellaer county, New York, July 20.

A knife made of saw plate, or any plate steel, is to be fixed to a frame which works up and down in vertical cheeks. The reams of paper to be cut are placed upon a shifting platform, under the knife, which is to be brought down upon it, by means of a lever. The patentee claims the use of knives so made; the use of lever power in bringing the knife down; the cutting of wet paper, made by cylinder machines; and the use of the machine in cutting paper "not interfering with any other improvement heretofore known or used."

A patent was granted to John M'Clintock, of Chambersburg, Pennsylvania, on the 31st March, 1827, for a machine for trimming the edges of paper; which machine consisted of a knife, brought down by a lever, similar to that above described. This probably may be news to the present patentee, but if the two interfere, as we are convinced they do, the concluding proviso of the claim will not operate as a saving clause.

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32. For a *Press for Cotton and other fibrous substances;* Philenzo Payne, and Joshua Rundell, Port Gibson, Claiborn county, Mississippi, July 20.

This is a vertical press, the follower of which is to be forced down by toggle joints. Within each of the cheeks of the press there is a toggle joint, from the middle of each of which an arm or shaft, extends forward of the press, in a horizontal direction. The power is applied to these arms, to draw them forward, and consequently, to bring the levers of the toggle joints in a right line with each other. The lower sides of the projecting arms form racks, which take into teeth upon a cylindrical shaft, crossing in front of the press. A vertical shaft turns the horizontal one by means of bevel gear. A horse, or other power, may be applied through the medium of a lever, or sweep, to the vertical or main shaft, when the follower will descend. The claim is to the press as described.

We apprehend that this will not be a good press for the purpose intended, on account of the smallness of its range. When a follower is to go but a short distance, and to act with immense power at the end of its range, as in the printing press, the toggle joint offers every possible advantage: but the pressing of cotton, and other light fibrous articles, requires a press with a very long range, as well as of great power, and there are many presses now in use for this purpose, which combine these qualities in a way greatly superior to that now proposed.

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33. For a *Machine for Planing Boards;* Joseph Percival, Northern Liberties, Philadelphia county, Pennsylvania, July 20.

If this machine is a good one, it is unfortunate in not coming before us with a favourable introduction. A more inadequate description could not well be given, and although considerable pains have been taken with the drawings, they afford but a very incomplete representation of the details of the machinery. Some of the wheels are called segment wheels, whilst, according to the drawing, there is not one answering to this name in the whole machine.

The cutters, or irons, are, it seems, to be fixed in a frame, and are to operate in the manner of ordinary plane irons, the frame containing them being passed backward and forward over the board, by a chain attached to it. The driving wheel is a large cog wheel, called a large *segment* wheel. This drives two pinions, or small cog wheels, also called *segment* wheels. The shafts of these pinions have wheels upon them, which take into the links of the chain which moves the plane. There is a contrivance for throwing these latter wheels alternately out of gear, in order to change the direction of the machinery.

The whole apparatus is complex, and inartificial; and is certainly very inferior to some of the planing machines previously in use. There is no claim made, the general arrangement being undoubtedly, and, we apprehend, correctly, considered as new.

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34. For an improvement in the Machinery for *Winnowing and Cleaning Grain;* Joseph D. Prescott, Chesterville, Kennebec county, Maine, July 20.

A trifling alteration in the mode of working the Dutch wheat fan, as generally used, constitutes the whole of this invention, all that is claimed being a kind of cam shaft, for moving the shoe and sieves, called by the patentee a "re-acting screw shaft," and an arrangement for altering the inclination of the sieves.

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35. For a *Plough;* Albert Peebles, Henry county, Georgia, July 20.

This plough is to be used in the cultivation of cotton, and of corn. It is furnished with two feet, on each of which there is a shovel iron, or a shovel iron on one of them, and the other made in the common form of the share plough.

The *inventor* states that this contrivance was made by him in May, 1816. He has been somewhat tardy in obtaining a patent, and if his neighbours have used it during the interval, which they had a perfect right to do, his claim now will prove something worse than equivocal.

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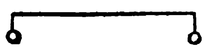
36. For a *Thrashing Machine;* James B. Palmer, city of Baltimore, July 20.

The beaters of this thrashing machine pass from one circular head to another, on a revolving shaft; but they are not fixed immoveably to these heads as is ordinarily done, but each of them works upon joints at their ends, allowing them to give way in passing over the straw after the stroke. To effect this they are bent at right angles at each end, thus,  and a pin, or screw, passing through an eye on the bent parts, attaches them to the drums, near their peripheries, and thus affords them the required play: about six of these beaters, standing two inches clear of the heads, is considered a good arrangement. The other parts of the machine differ but little from those generally used.

It is proposed sometimes to remove these beaters, and to attach to the heads, pieces furnished with spikes, and also to add a concave with spikes; thus converting the machine into the common cylinder thrashing machine. The beaters, as described, are claimed, and also the converting this instrument into a thrashing machine of the usual form, by the alteration above indicated.

We do not recollect having seen moveable beaters constructed and attached in the manner above specified, and think this therefore a valid claim; the second, however, we think altogether equivocal, as it consists merely in converting the original machine of the patentee into one for which he, confessedly, could not hold a patent.

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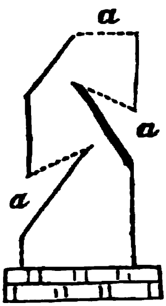
37. For a *Smoke Preventor;* Levi Silliman, city of Albany, state of New York, July 20.

This smoke preventor is an iron chimney cap, intended by its



particular construction to prevent the smoke from being blown down the flue, in whatever direction the wind may be. The mode by which this is attempted to be accomplished is the causing of the wind always to strike upon an inclined plane, by which it shall be directed upwards, and carry the smoke with it. The subjoined sketch, may represent one of the iron plates, with openings at *a, a, a;* the lower sides of these form the inclined planes, whilst the upper sides, with dotted lines, are unobstructed.

Plates, it is observed, may be fixed in the flue itself, having the required inclination, and openings left in the sides of the chimney will then serve the purpose of the proposed cap.

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33. For an improvement in *Fire Places*, called "the inverted arch, or curved mantle, for fire places." Elijah Skinner, Sandwich, Strafford county, New Hampshire, July 20.

This is intended as an improvement upon a plan patented by the same gentleman in April, 1822. He now proposes to form the upper part of the fire place by bending iron or brass plates, long enough to reach from jamb to jamb, so that they shall form segments of cylinders. These are to be fixed with the concave side outwards, the convex sides forming the front of the throat of the chimney, having the same curvature which Count Rumford prescribes for this part. When houses are newly constructed, it is proposed to form these breast pieces of cast iron, which may be built into the brickwork and *form its support, instead* of the ordinary arch, or iron bar.

We do not perceive in what respect this is an improvement upon Rumford's mode of construction.

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39. For a *Cutting and Punching Machine*, for iron, copper, brass, &c.; John Shugert, Pittsburgh, Alleghany county, Pennsylvania, July 20.

This machine consists mainly of the common cutting shears worked either by a double or single lever. That side of the shears which rises is kept in its place against the stationary cutter by a standard in the bench, which standard presses upon the outer side of it, and is capable of being adjusted to it.

The punching part consists of a punch fixed in the upper shear, just in front of the cutters, with a bed piece upon the bench below it. As the lever, therefore, forces down the cutting shear, it will cause the punch also to operate.

"*The* part of the above machine which the *inventor* particularly claims, *is the* post and slide at the back of the upper frame, and the power by which it operates." And we think that this is claiming quite enough in all conscience, as nothing is more common than to allow the shank of the upper shear to rise between cheeks; and "the

power by which it operates," is universally employed for the same purpose. What has become of the punching part?

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40. For a *Machine for Weighing;* James S. Seger, city of New York, July 20.

Without a drawing we cannot give a precise idea of this machine, and although there is some ingenuity in its construction, we apprehend that it will not, to any extent, supersede the usual process of weighing, and shall be satisfied with giving a general idea of it.

The weight of any article is to be indicated upon a flat round metallic plate, which is suspended vertically by a clevis and ring above it. When a weight is hung to a hook, pendent from a clevis which receives the circular plate in a slot, and allows it to play freely, the plate is canted on one side in a degree proportioned to the weight. An index upon the plate, which turns loosely upon a pin, and, therefore, always hangs vertically, points to figures which indicate the weight.

The circular plate, and the loosely pendent index for pointing out the weight, constitute the claims.

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41. For a *Machine for making Hooks and Eyes;* James Stewart, formerly of Montrose, in Scotland, but for two years past a resident of the city of Boston, in the state of Massachusetts, July 20.

This is a very complex machine, but it is perfectly well represented in the drawing, and fully described. Machines for the same purpose are in use in different countries, and how this may compare with those before known we are unable to say.

The claim made is to the combination of well known machines, or elements of machines, to produce the intended effect.

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42. For a *Machine for preparing Mortar for making Bricks;* Oran W. Seeley, Williamson, Wayne county, New York, July 20.

This machinery, in its general structure, resembles some others now in use for the same purpose. A circular trough is prepared into which the clay is to be put. A horizontal shaft, working upon an upright in the centre of the trough, when forced round, causes wheels to run over the clay, the wheels having a traversing motion to and from the centre. The arms of the horizontal shaft have each a screw cut upon them, these work in the hubs of the wheels, and cause them to traverse; one of them is a right, and the other is a left handed screw; in consequence of which, both the wheels recede from and approach the centre at the same time. Each wheel, instead of having a single rim, has four rims, or sets of felloes, supported by spokes from one common hub, the advantage of which is manifest.

The claims are to the right and left handed screws, and to the particular construction of the wheels.

43. For an improvement in the *Axles of Wheels for Railway Carriages*; Ross Winans, city of Baltimore, July 20. (See specification.)

44. For a *Lever Power and Inclined Wheel for Propelling Machinery*; Peter Wykoff, Westfort, Oldham county, Kentucky, July 20.

We have here the ghost of Redheffer's perpetual motion. This sprite, it appears, has been called from "the vasty deep," or elsewhere, has wandered towards the west, and taken up its abode with the present patentee. On revisiting our country he has evidently acquired more confidence than formerly, as he comes forth without that disguise with which he was enveloped in his Redheffer service.

The *inclined wheel* above named, is a *vertical wheel*, the axis of which is horizontal; upon the rim of this wheel a kind of carriage is to be placed, which carriage, as carriages ought to do, rests also upon wheels of its own. As this carriage is placed about forty-five degrees from the apex of the *vertical inclined* wheel, the vehicle will itself be inclined to run down, and fall to the ground. To counteract *this inclination*, a strap passes round a whirl, or drum, connected with the carriage wheel, and, inclining upwards, embraces another whirl, connected with ratchet wheels and palls, which are to correct its inclination to work too rapidly. To this system of ratchet wheels and palls there are appended various other contrivances to communicate the latent motion which exists in the inclined carriage, in proportion to its load, and which for its development requires nothing more than to cut the strap by which its inclinations are checked.

To the curious who wish for further information upon this subject, *we can only give a reference* to the files of the Patent Office, as we *have, no doubt*, already said more about the affair than will accord *with the inclinations* and anticipations of the *inventor*.

45. For a *Compound Revolver for Roping Cotton*; Asa Whitman and Joel Baker, Walpole, Norfolk county, Massachusetts, July 20.

This is a very ingeniously contrived apparatus, and one which we have no doubt will accomplish its purpose in a very satisfactory manner. The patentee states that it is not only more simple than the instruments in common use, but that it is operated on with much less power, is more readily adapted to different numbers of roping, and is easily kept in repair.

A verbal description of it, without a drawing, would be altogether unsatisfactory, and therefore we shall not attempt it.

46. For an improvement in the *Making of Pumps*, for drawing water from wells; Shadrach W. Allen, pump maker, Geneva, Ontario county, New York, July 21.

A pump maker ought to know how pumps have been made; especially such pumps as are familiar to those who are at all conversant

with the subject. As, however, we have lawyers who have acquired but little knowledge of law, and doctors who have never studied medicine, we may well excuse the artisan who manifests a want of learning in the history and progress of the arts.

The pump before us has two barrels, and two piston rods, worked by one lever. We are told that "all the interior is of metal, excepting the lining of the valves, the block, and a part of the lever," and that a spring passes round the piston, and keeps the leather covering quietly pressed against the chambers. This pump the patentee avers is superior to any other now in use; which superiority results from its having two chambers and pistons moving alternately in opposite directions, thus keeping up a constant stream. He says, also, that it has less friction than the common pump, and will deliver more water with less power applied.

If there is a common fire engine in Geneva, the patentee may see his two chambers, pistons, and rods, and all of them made of metal; and if he will turn to any good work on hydraulics, he will find that a double chamber pump is no novelty in its application to other purposes. Although he does not specify his claims, the above named are the points most prominently noticed in his description, and we infer, therefore, that these were intended to be the subject of his patent.

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47. For a *Thrashing Machine, and a Horse Power, for operating said machine;* Nehemiah P. Stanton, Syracuse, Onondaga county, New York, July 21.

The thrashing machine is described in the usual terms, applied to this instrument; we have talked about the different parts so frequently, that we are tired of the subject. There, however, is a claim made in the present instance, which is to "the uniting beaters and spikes on the same cylinder with the cast iron concave bed, and the sheet iron cap, and the construction of the dust discharger." All that is said about the dust discharger is, that "there is a feeding table, with a throat to receive the grain, and directly over it a throat to discharge the dust."

The horse power consists of a large horizontal wheel turned by a lever, projecting from its vertical shaft; this is geared to a smaller wheel which turns a horizontal shaft carrying a drum and strap, which gives motion to the thrashing machine, or to any other machinery required to be operated upon. So far all is according to the well established plan of such machines; the novelty of this horse power consists in placing the wheel work under ground, and allowing the main shaft to project up through the framing, the horse walk being above them. A *diamond* gudgeon is to be formed on the top of the vertical shaft, to receive the mortice of the lever by which the horse draws. The claims relating to the horse power are to the running of the gearing below the lever by which the horse draws. The communications from it to the thrashing machine, by bands, ropes, &c. &c. &c., the placing the lever at top, and the diamond gudgeon.

This patent is taken, not only plainly, but confessedly, for two

distinct machines, the application of the horse power to other purposes being particularly noticed; they should, of course, have been the subject of two patents; the claims to the two are separately made as to two machines. But independently of this consideration, there are parts of each of the machines claimed, which present no novelty whatever.

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48. For improvements in the *Machinery of the Steam Engine*, parts of which may also be applied to the gates of water mills, canal locks, &c.; William A. Turner, Washington county, North Carolina, July 21.

The present patentee has laboured very assiduously for the attainment of his object, as we have already noticed two patents obtained by him within about four months, each having the same end in view and by means very similar. The first of these is noticed at p. 14, vol. viii. and the second p. 112 in the same volume. The specification before us extends to twenty-seven closely written pages, and to as many of drawings and references, and although several of its propositions now made bear a very near resemblance to, and are indeed identical with those in the patents which preceded it, there are, of course, some novelties presented to us.

The propositions relative to the steam engine are, 1st, to ascertain the quantity of water in the boiler. 2nd. To prevent its overheating. 3d. To open large holes for the escape of steam when necessary, and to force a considerable quantity of water into the boiler at once. 4th. To cause the induction valves to open with great ease.

We can give no more than a brief notice of these various propositions; and, most probably, the greater number of our readers will wish that we had been still more brief.

In order to ascertain the quantity of water, the boiler is to be suspended on a balance, like a scale beam, or it is to be contained on a float, by which both it and its contents may be accurately weighed; there being an index to point out the weight, or otherwise an alarm is to be sounded as it ascends by becoming too light. There is to be an apparatus of wheels, &c. to move the index for pointing out the weight; or when the boiler is made to float in a shallow box containing water, and fitting into it water tight, a tube is to extend upwards, to weigh the boiler, &c. hydrostatically, by the ascent of water from the reservoir.

We have not time, and, to any engineer it would be labour lost, to animadvert on the absurdity of this proposition; not on account of its mechanical difficulties merely, but from the absolute impossibility of carrying it into effect in a working engine. Besides the ascertaining of the actual weight of water, the boiler, as it rises by its levity, is to let go a damper, to check the fire, and at the same time to open certain apertures, which are to pour water on the fuel.

To prevent overheating, the inside of the boiler and flues, in contact with water and steam, are to be coated with such metal as may be found least apt to rust. This, of course, must be silver, gold, or

platinum; how this lining is to effect the purpose, we do not perceive. Tubes are to pass entirely through the interior, and the top and bottom of the boiler; in these tubes plugs of fusible metal are to be inserted near to their lower ends: rods are to extend down these tubes and rest upon the fusible metal, and when this compound melts, the rods are to descend, and pull down levers which shut the aforesaid damper, and open apertures admitting a shower to fall upon the fire.

To open large openings for the escape of steam, small valves are to be provided, which are to act upon certain doors, and thus open large holes, for the discharge of the steam, and they are at the same time, like the other contrivances, to close the damper, and to open the holes which are to deluge the fire. We were about to give some idea of the method by which the steam issuing from the small valves, is intended to open the large doors alluded to, but it would require too many words, and we must spare ourselves and our readers this trouble; referring those who wish to know all about it to the specification. We must also take the same course as regards the easy opening of the valves, and the application of the same principle to the gates of water mills, and to the locks of canals. Like the former patents of this gentleman, his propositions are made, without specifying those parts which are new; and the same things are in some instances proposed in each of his patents. Most of his contrivances it is true, have the merit of novelty; we wish that we were able to add, and of utility.

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49. For *Fastenings for Doors and Windows*; James R. Post, city of New York, July 21.

This fastening is a spring bolt. A tube is to be provided which will receive the bolt; a spiral spring is to be put into this tube, and the bolt then passed in over it. In the edge of the lock rail of a door, or the rail of a sash, a hole is to be bored, to admit the tube with its bolt. Knobs are to be applied, to force the bolt back: for this purpose a slot is left in the tube, and a screw hole made in the bolt; a corresponding mortice, or opening, must, of course, be made in the rail, through which the knob may be screwed into its plate, and fly backward and forward.

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50. For an improvement in machinery, called the *Circular Wedge;* Silas Underwood, Hardwick, Caledonia county, Vermont, July 22.

The so called *circular wedge*, here patented, is no more than the common eccentric, so generally applied to machinery. We are told that it is a complete substitute for the crank. It is represented as applied to a saw mill, and also to the beaters of a fulling mill. Were it new, it would be no improvement as applied to the former, and if used to move the latter, it would be but a poor affair. Has the patentee lived in the present day without seeing his *circular wedge* applied to the opening and closing of the valves of a steam engine?

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51. For an improved *Metallic Mould for casting Butt*

Hinges; Jonas Kendall, jr., Watertown, Middlesex county, Connecticut, July 21.

A metallic mould suitable to receive the metal, is made in two parts; these are to be fixed opposite to each other within double levers, which open and close like tongs. The moulds are held together, the metal poured in, and on liberating them, a spring between the levers separates the two parts, and a pin forces the cast piece out, before it has time to cool, so as to harden or break.

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52. For a *Thrashing Machine;* Benjamin Balch, and Luke Webster, Sweden, Monroe county, New York, July 22.

The claim made, is to the placing the iron beaters which surround the cylinder in an oblique direction, alternately sloping different ways. The object proposed by this arrangement has been repeatedly effected.

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53. For a Machine for *Cutting Dye Woods;* Merrit Hurd, Augusta, Oneida county, New York, July 22.

There is a part of this machine, which, in the specification, is called a cylinder; but it is in fact the frustrum of a cone: one of its ends is six, the other ten inches in diameter, and eight in length. This part is made of cast iron, about five-eighths of an inch thick, and with a head or bottom to the smaller end; through this passes a horizontal shaft, by which it is made to revolve. A longitudinal mortice, like the mouth of a plane, is made to receive the iron which is to cut the dye wood, the chips from which pass through to the inside of the cone, and fall out from its open end. There is a rest provided to sustain the wood to be cut; and a weighted arm upon the shaft, to operate as a fly wheel, to give momentum to the cutter.

There is no claim made, the general construction of the machine being considered as new. It is certainly simple, and, we have no doubt, effective.

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54. For an improved *Corn Plough;* Nathaniel Ethridge, George Heath, and Ira Glynn, Little Falls, Herkimer county, New York, July 23.

This is a plough, which consists of several parts, which are made to shift, in order to adapt the instrument to the respective purposes which it is designed to answer.

When the plough is used for ridging and hilling, it has a mould board, which is double, throwing the earth equally each way, and a chip with double wings. There is also an instrument called a drag, which is sometimes connected to the plough by suitable irons. This is used, for example, in the first hoeing and weeding; the mould board being removed, but the share and chip remaining in their places. The drag operates as a harrow, or rake; it consists of two bars of iron, standing obliquely to each other, their wider opening being towards the plough, and furnished with teeth which drag upon the ground.

The claims are to the chip with double wings; the double mould board, made to take off; and the cast iron harrow, or drag.

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55. For a *Thrashing Machine;* Jacob Redifer, Philadelphia county, Pennsylvania, July 25.

The parts of this thrashing machine are the same with those most frequently described; the position of the hollow segment is, however, different from that usually adopted, as it is placed directly over the revolving beaters, or cylinder. The feed board is inclined upwards, so that the straw may pass over the cylinder, and under the segment, which has a cap to retain the grain. The cylinder must, of course, revolve in a direction the reverse of most of those used; and the grain and straw are to be delivered in front, a little above the axis of the cylinder. A rack of wood, or wire work, extends from the front of the machine in an inclined direction, to carry the straw out of the way, and allow the grain to fall through.

The claims are to the position of the feed board, with its highest end towards the cylinder; and to the rack in front of the machine. Our impression is that the claim to the latter is of doubtful validity, as there are machines patented, which thrash and winnow at the same time; the grain and chaff falling through a rack, or screen, in front, and being then operated upon by fans.

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56. For a *Thrashing Machine,* for thrashing rice, and other small grain; Samuel Rogers, Ashville, Buncome county, North Carolina, July 28.

The only difference which we discover between this and the great number of thrashing machines, consists in the ease with which the patentee avers that it operates; for although it is precisely like many others, he declares that it may be worked with half the power usually found requisite. The "why and because" are not given, nor is there any part designated, or claimed, as new.

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57. For a *Brick Press;* Thomas A. Fricks, Harrisonburg, Rockingham county, Virginia, July 29.

There is nothing very special in the construction of this press, to mark its superiority over others previously in use. The brick is placed in a double mould, which is then slid to its place, when a lever, attached to the lower framing of the press, is forced down, and brings a piston to bear forcibly upon the brick; as this lever is brought down, it acts upon another, which raises the brick to the top of the mould. No claim is made.

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58. For improvements in the *Machinery for Cleaning Rags,* used in Paper Making; George Carriel, Manchester, Hartford county, Connecticut, July 27.

A common screen for cleaning rags, used either with or without pins, or knives, is to have wings, composed of thin pieces of wood or metal affixed upon its outside, and extending from end to end, in order to create a wind by their motion. This screen is to be placed

in a round case, or chest, a little larger than itself. An opening is left along the whole length of this chest; which opening, if the screen be four feet in diameter, may be about sixteen inches wide. The whole should be in a large enclosure. The rapid motion of the cylinder will carry the dust through this opening. The improvements claimed are the use of the wings, as described; and the case with the opening for carrying off the dust.

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59. For an improvement in the *Running of Stones for Flour Mills;* John Clyde, Fallowfield, Crawford county, Pennsylvania, July 27.

The object of this patent is to secure the particular construction of the spindle, and the step in which it works. The upper stone is to be the runner, the spindle being fixed in it for that purpose, and extending above to a piece of timber in which its upper end revolves. A bolt of iron extends through the lower stone. The upper end of this iron bolt is hollowed out, and forms a step for the running spindle; it is fitted so tightly in the stone as to be raised by a hand pole, attached to the bridge tree, and to be lowered by the weight of the upper stone. The stone is to be propelled by a whirl on its top, with an opening over the eye. The claim is to the spindle and step.

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60. For a *Bee House, and the Cultivation of Bees;* Philip Munch, Putnam, Muskingum county, Ohio, July 27.

The bee house, ten and a half feet long, and four feet deep, may contain three different apartments. It is proposed to place the front of the house towards the east. The house is to stand upon legs, consisting of timber properly framed together. The roof is to slope back, and each of the compartments is to be furnished with a door, two feet long, and two feet wide, to allow of putting a hive into it. This door may be furnished with a pane of glass. The apartments are to be closely planked without and within. Openings are to be left in front for the entering of the bees, and ledges placed along for sheltering them, and for them to alight on. When a hive of bees is placed in one of the compartments, the top of the hive is to be gently removed with the proper precautions. The rooms, or compartments, are cleated round, to sustain small sticks, which, with the cleats, support the comb which the bees will eventually build around the hive, and on to the sides of the compartments. The hive is to be raised from the floor by a block under each corner, to allow a free passage for the bees.

A swarm of fresh bees may, if preferred, be put in without a hive; the great object being to give them abundant room, that they may not be compelled to swarm, as from a common hive. By thus giving them ample space, it is said that many advantages are secured Swarms often perish from their swarming late in the fall, which this plan prevents; the practice of killing the bees is rendered entirely unnecessary, as the comb may be cut out at any time when it may be wanted for use, especially in winter; the bees having ample room, will have no inclination to swarm, and will therefore collect honey much more rapidly than usual.

or driving lever, which acts upon the progressive levers, or toggle joint; the arrangement of the machinery being such as to cause this to be done in nearly a direct line. It would require a drawing to explain the precise mode of effecting it, but the skilful machinist will, probably, catch the general idea from a short description. The lever with which the pull is made, has two projecting pieces at the head of it, giving it somewhat of a T form; in one of these projecting pieces, there is a friction roller which bears against the face of a piece of metal, which may be cast with, or attached within, the frame, or cheek, of the press. The opposite projection, through the intervention of a jointed lever, forces the pitman forward, upon the progressive levers. We think the arrangement a very good one, and a real improvement on this part of the printing press.

Specifications of American Patents.

Specification of a patent for a Hydrostatic Safety Valve for Steam Boilers. Granted to Thomas Ewbank, *city of New York, August 27,* 1832.

With a Copperplate.

To all whom it may concern, be it known, that I, Thomas Ewbank, of the city of New York, have invented a new safety valve, for the boilers of steam engines, which I denominate the hydrostatic safety valve, and that the following is a full and exact description thereof.

The form of my safety valve may be the same as that ordinarily used, namely, a truncated cone; instead, however, of being pressed downwards in the usual way, it is pressed upwards, by the weight of a column of water, mercury, or other fluid.

In the accompanying drawing those parts which are similar in the different figures are represented by the same letters.

Fig. 1 represents a section of the vessels by means of which the hydrostatic pressure is made. A, is an inner cylindrical vessel, which may be open at top, but is closed at bottom. This is placed within a second vessel, B, which is to contain water, or other fluid, by which the pressure is to be made. It is evident that when the vessel A is placed within the vessel B, and water is poured into the cavity between them, A will be pressed upwards with a force proportioned to the area of the bottom of A, and the altitude of the fluid in the cavity. C is a shallow vessel in which B stands, and is intended to receive any fluid which may escape from B. D, E, F, are cocks placed in B, to regulate the height of the fluid, and consequently to graduate the pressure; say to 50, 40, 30, and 20 lbs. to the square inch. G is a disk of wood, or other light material intended to stiffen the bottom of A, and which may also serve to receive the lower end of the valve rod, each end of which passes into cavities without the use of joints as ordinarily made.

Fig. 2 is a section of the valve in action. H, H, is a tube, one or

both ends of which open into the boiler at I, I. The inverted valve seat is seen at J in the upper part of this tube. K, K, are ledges to support the hydrostatic apparatus above the boiler. A piece of plank, or other bad conductor, is usually first placed upon the ledges. The valve L is drilled deeply on its lower side, to receive the rod M, the lower end of which rests on G.

Fig. 3, is a perspective view of the whole apparatus, the graduation by means of the corks being represented by figures.

As the steam in blowing off passes downwards, I usually place a cover on the vessel A, as shown at N, Fig. 4. A hole left in the centre of this cover allows the rod to play through, and a collar, O, formed upon the rod may cover the holes.

Fig. 4, represents a valve in its usual position, this section shows two holes drilled through the valve at P, P. I intend sometimes to drill a number of such holes, to prevent, or lessen, that adhesion which is known to men of science as having been described by Mr. Clement. The same provision is shown at Fig. 5. These holes I intend, in some instances, to connect together by turning grooves on the face of the valve, removing a portion of metal between them.

By the arrangement here described, the danger which arises from overloading the safety valve is entirely obviated, or rendered so difficult, and so palpable, if attempted, as to afford complete security on this score.

I have thus given particular exemplifications of the principle upon which my improved valve operates, not, however, intending to confine myself to the precise arrangement herein set forth, as this may be variously modified, whilst the general principle remains unchanged.

What I claim as my invention is the employment of hydrostatic pressure *to close the* safety valve; the using of the valve in the reversed position; the passing the ends of the valve rod into cavities prepared to receive them without the use of joints; and the drilling of holes through the valve, as above described, in order to prevent adhesion.

Thomas Ewbank.

References to the Plate.

Fig. 1. Section. A, the inner cylinder closed at bottom. B, outer cylindrical vessel containing the water. B, lower vessel to receive the waste water from B. D, E, F, cocks to regulate the height of the water.

Fig. 2. Section of the valve in action. H, H, tube opening into the boiler at I, I. J, inverted valve seat. K, K, ledges or brackets which support the apparatus. L, valve. M, valve rod.

Fig. 3. Exterior view. The numerical figures exhibit the graduation by means of the cocks.

Fig. 4. Section, showing N a cover to the middle vessel, and O, a collar on the valve rod, to prevent the steam entering it; holes are also shown as drilled through the valve to prevent adhesion. These

are also shown at P, P, Fig. 5, where the valve is in its ordinary position.

Fig. 6. In this figure the dotted lines show how a tube may be placed to direct the steam upwards.

Fig. 7 shows a glass tube, substituted for the graduating cocks. This tube communicates at bottom with the water in the vessels; it is open at top, is graduated, and protected by a metallic case, with a slat its whole length to allow the height of water to be seen, the graduations being made either on the tube or its casing.

Remarks by the Patentee.

The defects in, and abuses of, the ordinary safety valve, which I have attempted to avoid in this, are,

1st. *The facility of overloading it, and that to any extent.*—This defect is greatly diminished, if not entirely obviated, in the hydrostatic valve; for when the extreme force of steam intended to be used in a boiler is determined, the diameter of A, and depth of B, are regulated to the pressure required, so that when the cavity between them, is *filled* with water, (or whatever fluid they are designed for,) the amount of pressure on the valve is then at its maximum: it cannot be increased: consequently, the elastic force of the steam can never rise higher than is sufficient to open the valves against that pressure.

The cocks are merely to ascertain, if desirable, the force of the steam when *below* its maximum.

2. *The strength of steam required to open the common valve cannot accurately be ascertained.* This arises from several causes, as *the friction of the lever and connecting rod joints;* which, from rust, &c. is often considerable, and cannot be exactly calculated, because not uniformly the same; *the mode of raising the valve by the lever,* which has a tendency to draw the top of it towards the fulcrum, and to move its spindle in an opposite direction to one side of the hole in the guide piece, against which it rubs; *uniting the valve to the lever by bolts* through the connecting rod, increases the evil, because the necessary play of these bolts, and the wear of the holes, prevent the true centre of pressure from being always precisely on the centre of the valve; consequently, the steam cannot raise it perpendicularly, but will influence it in an oblique direction, towards that side on which the external pressure is greatest; this will, of course, move its spindle in a contrary way when it binds itself against the guide piece as above mentioned. Its resistance, in such circumstances, will increase with the increasing force of the steam.

In the hydrostatic valve the whole of these defects are avoided. The bolts and lever are not used at all; and the rod which communicates to the valve the pressure against it, being tapered at its ends, presses only on its central points in countersunk holes; one on the under side of the valve, and the other on a piece of iron or brass attached to the bottom of vessel A. There is no friction in obtain-

Ewbank's Hydrostatic Safety-Valve

Fig. 1.

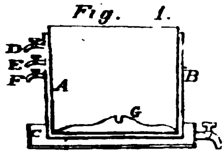


Fig. 2.

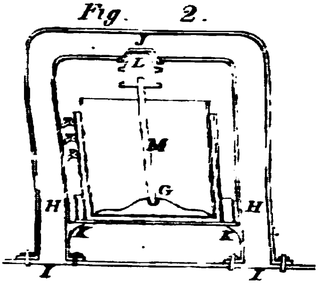


Fig. 3.

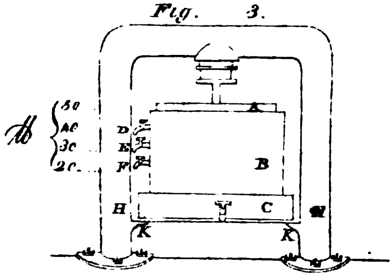


Fig. 5.

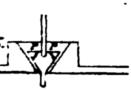


Fig. 4.

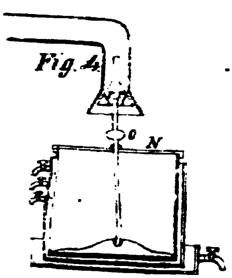


Fig. 7.

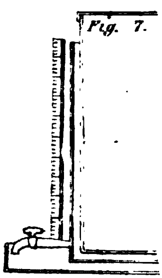
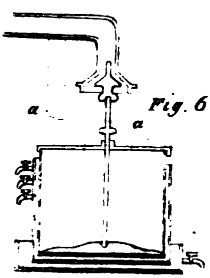


Fig. 6.



ing the pressure on this valve, and nothing to prevent the steam from opening it in a perpendicular direction. It is left freely to its influence.

The *amount of pressure* upon it is also very simply, and most accurately made known, *even to the fraction of an ounce;* thus, when the valve, rod, and vessels, are in their places, water is poured into B *till it rises to the brim;* then by disconnecting the valve from its seat, and allowing the water to act freely on the inner vessel, this vessel, A, will instantly rise, from the pressure of the water in B. Weights are then put into, (or upon,) A, sufficient to sink it, till the water rises to the brim of B, as before; and the amount of these will be the greatest pressure which can be obtained by it against the valve. In putting in the weights it will be found that when the water has risen near to the top of B, the addition of one-fourth or one-half of an ounce weight, will very sensibly affect it. The same method may be taken in ascertaining the position of the cocks.

In one of these valves, which I have had in use for several months, *the action* has been surprisingly accurate, and I am not aware of any *deficiency in* it whatever. I have frequently found that when the steam has risen high enough just to open it, a wine glass of water poured into B, (if not filled at the time,) would instantly close it. The diameter of A is thirteen, and depth of B twelve inches. They are made of sixteen ounce copper, and when B is filled with water, the pressure on the valve is fifty pounds.

3. After the maximum strength of steam intended to be used is determined, great caution is necessary in adjusting the *common valve*, that no more than the relative pressure be permitted to act upon it; *yet there is reason to believe that*, in many cases, nothing more is *calculated than the* mere weight *on* the lever; the weight of the valve *itself, the rod*, bolts, and lever, not being taken into the account at *all, although their* united weight may be of much importance, especially on small valves. But, in some instances, when they have been taken into the account, (as the foreman of an engine factory informed me,) they were only weighed together, *before being fixed in their places.* That this is a material oversight is evident, since their weight, and the power which they exert on a valve when fitted to their places, are essentially different; thus, a rod, valve, lever, and bolts belonging to a boiler I have in use, weigh together only four pounds, but when in their places, the pressure of the lever on the valve, is upwards of twelve pounds; and as its area is but 1.5 inches, there is a pressure on it, *before any weight whatever is placed on the lever*, of more than eight pounds on the square inch! an amount of too great importance to be overlooked, and more especially where mercurial gauges are not used to correct any errors of the lever.

In the hydrostatic valve it will be seen that all inaccuracies and consequent danger from these sources are wholly prevented *by its inverted position.*

4. The common valve when opened by an excess of steam, may be, and often is, improperly closed before that excess is discharged, either by increasing the weight on the lever, or moving it further

from the fulcrum; (and in this manner the pressure on the common valve may be increased indefinitely, at the pleasure of the attendants,) but the hydrostatic valve cannot be closed at all till the steam has subsided to its prescribed force, when it will shut of its own accord. Indeed the steam must subside a little *below* its extreme force before the valve can be closed again, because by its opening, the vessel A is depressed, which expels a portion of the fluid out of B, and the pressure on the valve is therefore diminished in proportion to the quantity of the fluid so expelled.

5. Common safety valves are generally made so as to be, when closed, level with, or a little above the tops of their seats; in consequence of which, when opened, steam issues from them in nearly a horizontal direction; and "as a strong current of air will be created by the velocity of the steam, and will pass off with it, the surrounding air will follow, and in its course will impinge on the valve, and cause a pressure:" but if the seat be made to project two or three inches above the closing part of it, and *incline a little inwards at the top*, and is of sufficient diameter to allow the steam to escape freely between its sides and the periphery of the valve, the steam would then issue in a column directly over it, and so prevent the influence of any atmospheric pressure whatever.

To derive the greatest advantage from this principle is the design of drilling a number of holes all round the closing part of the valve; which holes terminate on the top in a direction towards the centre. When it is opened, steam will pass through these openings in a quantity sufficient to destroy any partial vacuum that could be formed upon it by the lateral escape of the steam. These holes may be advantageously united by a groove turned around it, through them. It is not material that the valve should be tight to its seat on both sides of this groove; if it is so on that next the boiler, it will be sufficient.

The want of uniformity in the construction of safety valves, chiefly, induced me to propose these holes, to avoid any possible effect from steam forcibly escaping from a small orifice, under a valve or disk, in a radiant or star like form, as discovered by Mr. Clement. In very flat valves, which *overhang their seats*, and such there are, these holes may be serviceable; at the same time, I think it doubtful, whether a properly made conical valve, whose orifice is very little less than the valve or disk itself, would be much benefitted by them, except so far as they lessened the area, and adhesion to that amount, and what effect they might produce on the expansion of the metal and adhesion from that source.

Perhaps there is no part of an engine to which less attention is paid, than to the *proper angles* of the cone, or closing part, of safety valves. They vary, as fancy or caprice directs, from one degree to ninety; from a flat surface to nearly that of a cylinder! I do not know that the most eligible angle has ever been determined, but experience has led me to prefer that of forty-five, or near it; for if it be much less, that is, if it approach much nearer to the form of a cylinder, it would be more liable to adhere to its seat from expansion,

or other causes; and if the angle were greater, it would be more subject to the resistance observed by Mr. Clement.

6. It has sometimes occurred to me, that in accurately calculating the amount of pressure on a valve, allowance should be made for atmospheric pressure on the area of its closing parts: thus, a valve which is perfectly fitted to its seat may be turned upside down without separating from it, provided its weight be not equal to the atmospheric pressure on the parts in contact. And as the matter that accumulates on valves soon renders them perfectly tight, if not originally so, perhaps a deduction should be made accordingly. It is said, however, by some persons, that atmospheric pressure has nothing whatever to do with the adhesion of valves, but that they are held to their seats by cohesion, or the mutual attraction of their particles: if, however, the existence of this cohesion depend on the exclusion of the air from between the parts in contact, the pressure consequent on that exclusion must be overcome, *exclusive* of what further resistance is created by cohesion: and again, if cohesion also depend on the immediate contact of the particles of the valve and seat with each other, it is obvious that this can seldom take place, as valves are soon covered with saline and other matters which prevent that contact. But if cohesion were totally destroyed, would not a valve be still subject to atmospheric pressure on the area of its closing parts?

Some valves, as in steam-boats, &c. present an area of the parts fitted to the seats of two square inches and upwards; hence, if my opinion is correct, there is a pressure of thirty pounds from this source alone. But whether this adhesion be caused by atmospheric pressure, or by cohesion, while the effect is nearly the same, there can be no harm in making the calculation in the manner suggested.

The elevation of the hydrostatic valve above the surface of the boiler, and its inverted position, will probably render it less liable to adhesion than the common one, from any other source than that just mentioned. A portion of condensed steam constantly collects above it, and occasionally oozes out, and this circumstance alone may be very beneficial, by preventing the formation, or accumulation, of saline or other substances upon it, and even by lessening, if not destroying, the atmospheric pressure itself.

Thos. Ewbank.

New York, December 1, 1831.

Specification of a patent for a mode of manufacturing Rollers of Cast Iron for laminating or flattening of metals, and for other purposes. Granted to James Wood, *of the city of Philadelphia, July* 20, 1831.

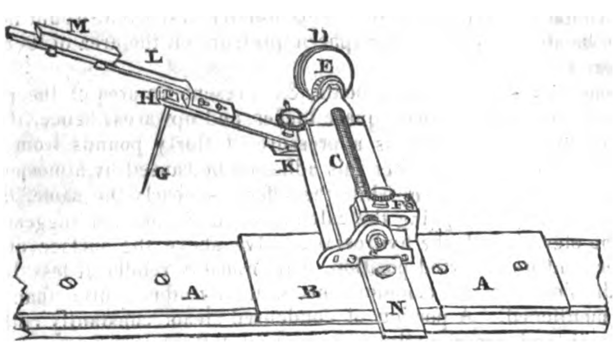
I make a shaft of cast or wrought iron, or of steel, or combinations thereof; upon and around this shaft I afterwards cast iron, so as to form the intended cylinder, or flatting mill roller, of the size, and

adapted to the purpose intended. This casting I sometimes effect in one operation, and at other times I complete it in successive operations. The final casting, by which the surface of the roller is formed, is usually made in a *chill*, or mould, of cast or wrought iron, turned perfectly true, and so constructed as to receive and retain the shaft, first named, exactly in its centre. The roller so cast, either chilled or not, may afterwards be dressed by grinding in the usual way, and the gudgeons, if necessary, may be turned. Such rollers may have grooves of various forms made in them, by preparing the *chill*, or iron mould, with such projecting rims, or ridges, as may be required.

What I claim as new, and for which I ask a patent, is the casting of iron rollers, either chilled or not chilled, for flattening or rolling metals, or other substances, upon shafts of steel, wrought or cast iron, or combinations thereof.

James Wood.

Engraving Machine. Invented by Mr. Jobard.



The experimental results of the above invention obtained for Mr. Jobard the large gold medal from the society for the encouragement of arts in Paris, in 1828. It is composed of a brass rule, A, one metre long, upon which slides a socket B, its internal divisions being furnished with flat steel springs. A very fine and closely wormed screw C, provided with a button D, and containing divisions E, is used to space out the lines according to the required distances. It plays in a bed F, which opens, in order that the screw may be returned without loss of time when it has gone its whole length; G is a steel graver, armed with a finely pointed diamond: a small vice H, fastens the point. A button I, furnished at the base with an inclined plane that moves upon a fixed appendix K, serves to keep the point raised when not required for use. A small square bar to which is fixed a cup M, receives leaden weights that communicate delicacy or force to the point of the graver. The piece N is intended to re-

lieve friction of the compartment C; it is attached to the socket or slider B.

Every one knows that it is next to impossible, with manual skill, to cover a somewhat extended surface with parallel lines, preserving a uniform space and consistency. The above instrument we conceive will be found essentially valuable to an engraver; for the only fault with which we can charge the old masters in this branch of art, lies in the inequalities that necessarily exist in the tracing of their grounds, skies, and, above all, in the field of their medals, which, otherwise, were admirably executed. The machine under consideration will remedy this imperfection, and impart to engravings of this class, a precision and velvet-like character extremely agreeable to the eye. It materially lightens the labour of the artist, and, moreover, some descriptions of drawings may be entirely executed by its means.

The following is the mode of laying down a sky upon a plate with this instrument. The first line nearest to the horizon is traced with the cup empty; before commencing a second line, a small shot of about a line in diameter is dropped into the cup: this is continued to the close of the operation by adding a shot to every line. The point being thus each time more weighted, the stroke necessarily becomes broader and deeper.—*Recueil Industriel.*

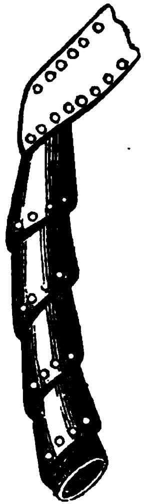
*** For machine, architectural, and other drawings of the same character, as well as of still life, the graver of Mr. Jobard will doubtless be found not only available, but useful. For the *poetry*, however, of this branch of the art, (if the reader will allow the expression,) no machinery can convey that enchanting effect of which the hand alone seems capable. We strongly suspect that if all the surfaces in a landscape of *Claude*, or *Gaspar Poussin*, to express which this instrument might be rendered available, were to be laid down with it, the result would be flat, hard and *brassy*. The lines, with all their proportions and graduations would doubtless be found mathematically correct; still we believe that that indescribable charm, that vivid effect, the soul of the art, and which seems to be communicable only by the immediate contact of the hand, would be found wanting. For laying down and shading architectural designs, and mechanical diagrams, we repeat that it may be found eminently serviceable.—*Editor Rep. Pat. Inv.*

Fire Engine Suction Pipes.

SIR,—In some towns in Belgium, the suction hose of the fire engines are made without any internal metal spiral to support them against the pressure of the atmosphere. They are formed, in the manner represented in the following sketch, by winding a broad leather strap round a mandril in a spiral direction, overlapping sufficiently at each coil to allow of a line of copper rivets being inserted.

When the rivets are set very close, and the coils are not above two

inches broad, such hose appear to have sufficient stiffness to answer the purpose intended, and to possess some advantages over those generally used in England.



Meteorological Observations for December, 1831.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches.				Inches.	
	1	23°	29°	29.65	29.70	12	NW.	Moderate.		Clear—overcast.
	2	24	35	29.90	29.80	18	W.	do.		Cloudy do.
	3	24	32	29.60	29.60	25	N.	do.		Cloudy do.
⊗	4	24	31	29.50	29.40	26	NW. SE.	do.	.4	Cloudy do. snow in the
	5	10	22	29.60	29.80	5	NW.	Blustering.		Cloudy do. [evening.
	6	10	22	30.10	30.10	5	W.	Moderate.		Cloudy do.
	7	14	22	30.10	30.10	10	W.	do.		Cloudy do.
	8	17	32	29.95	30.00	12	SW.	do.		Cloudy—clear.
	9	26	31	30.00	30.00	15	SW.	do.	.14	Snow—cloudy.
	10	20	30	30.20	30.20	15	NE.	do.		Cloudy—clear.
	11	14	32	30.30	30.30	13	NW.	do.		Clear day.
☽	12	20	20	30 10	30.10	10	W.	do.		Clear day.
	13	15	24	30.5	30.00	5	W.	Calm.		Light snow—clear.
	14	16	24	30.20	30.24	4	W.	do.		Cloudy day—snow in the
	15	16	19	30.20	30.20	8	NW.	do.	.15	Cloudy—clear. [night.
	16	4	22	30.10	29.80	6	SW.	Blustering.		Cloudy—clear.
	17	26	18	29.30	29.40	4	W.	do.		Slight snow—clear—very
	18	6	12	30.10	31.20	3	W.	Moderate.		Clear day. [blustering.
☺	19	16	34	29.90	29.80	11	SE.	do.		Cloudy—clear.
	20	14	22	30.5	30.5	6	SW. W.	Blustering.		Clear day.
	21	22	24	29.60	29.50	14	SW.	do.		Clear day.
	22	16	20	29.90	30.10	1	W.	do.		Clear day.
	23	5	25	30.30	30 30	2	W.	Moderate.		Clear—cloudy—snow in
	24	23	36	29.14	29.14	28	NE. SW.	do.	.40	Cloudy—clear. [the night.
	25	31	35	29.90	29.35	11	SW. W.	do.		Cloudy—clear.
☾	26	21	32	29.73	29.70	15	W.	do.		Clear—cloudy.
	27	19	22	29.70	29.72	6	W.	do.		Clear—cloudy.
	28	26	23	29.50	29.40	18	E. W.	do.	.42	Snow—cloudy.
	29	26	32	29.44	29.44	19	W.	do.		Cloudy day.
	30	12	20	29.80	29.90	2	W.	do.		Clear—cloudy.
	31	14	30	29.50	29.30	22	N. NE.	do.	.19	Cloudy—snow.
	Mean	18.19	26.19	29.83	29.81	11.32			1.34	

	Thermometer.	Barometer.
Maximum height during the month,	36. on 24th.	30.30 on 11th & 22d.
Minimum do. . .	4. on 16th.	29.14 on 24th.
Mean do. . .	22.19 . . .	29.83

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

FEBRUARY, 1832.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

NOTES OF AN OBSERVER.—*An examination of some remarks upon the application of water to wheels, which appeared in the 4th volume of this Journal. By* JAMES P. ESPY.

DEAR SIR,—In the Journal of the Franklin Institute, vol. 4, p. 166, there are some very judicious "Remarks upon Water Wheels, and upon some prevailing errors respecting the Application of Water as a Motive Power." But upon reading that part of the essay which relates to our works at Fair Mount, I was surprised to find a disparity between the power and the effect so great as three to one. Upon examining the principles on which the writer proceeded to deduce this unexpected result, I could find no inaccuracy sufficient to justify me in the conclusion that the writer was materially wrong, except in the quantity of water actually discharged upon the wheel in twenty-four hours. The method of calculating this quantity is not given by the writer, and the presumption is, that a due allowance has not been made for the "contracted vein."

According to the experiments of Venturi, confirmed by experiments of the Franklin Institute, not yet published, the area of the "contracted vein" is to the opening in the forebay through which the water is discharged upon the wheel, as 625 to 1000. Now as the velocity due to the head of pressure is at the "contracted vein," and not at the opening in the forebay, in calculating the quantity of water issuing on the wheel, the area of the "contracted vein" must be used.

In making the calculation on this principle, I find that the quantity of water discharged through gate No. 1, fifteen feet by seven and a half inches, in twenty-four hours, under a one foot three and three-fourths inch head, which gives a velocity at the contracted vein of nine feet per second, is about 28,000,000 gallons. Gate No. 3, which is sixteen feet by six and a half inches, gives a little less discharge in twenty-four hours, namely 27,630,000 gallons.

Now if one million and one-third gallons are raised into the reservoir ninety-six feet, above the level of the forebay, by each of these wheels, in a day, with a head and fall of eight feet, the power will be to the effect in the first wheel as one to 0.57; and in the other wheel as one to 0.58; whereas, the effect given by the writer mentioned above, is to the power only as 0.33⅓ to 1.

The writer has also estimated too high the retarding influence of the inertia of the water put in motion by the buckets with a velocity equal to the difference of the velocity of the bucket, which is twelve feet, and the velocity of the water in the direction of the circumference of the wheel. This difference, on the supposition that the water comes on the wheel one foot from the surface, at an angle of 45°, is 6⅓ feet.

The whole loss of power, he says, may be estimated thus: "The velocity of the water in the required direction, is that which is due to a fall of 5⅔ inches.

Immediately on striking the wheel, it receives a velocity due to a fall of 27 inches.

The difference indicates the power expended by the wheel in giving it that velocity, - - - - -	21⅓ inches.
The water comes on the wheel below the surface of the dam, - - - - - - -	12 inches.
Total loss, - - - - - -	33⅓ inches.

It appears to me that the following method of calculating is the true one.

The velocity of the water in the required direction, is 5½ feet.

Immediately on striking the wheel, it receives an additional velocity of 6½ feet, due to a head of - -	8 inches.
The water comes on the wheel below the surface of the dam, - - - - - - -	12 inches.
Total loss, - - - - - -	20 inches.

It may appear paradoxical, and to a hasty examination of the subject, inconsistent with the laws of hydrodynamics, to say that a wheel can move under any circumstances, with a velocity of twelve feet a second, without losing twenty-seven inches of power, which is the head due to this velocity; more especially if the water issues obliquely upon the wheel, as in the present case. But if it is recollected that water produces a greater mechanical effect by gravity than by impulse, the paradox will vanish: for in the case we are now considering, the water, by lying on the buckets while descending eight

inches, will, by its gravity, produce as great an action on the wheel, as the reaction had been by impulse.

Thus it appears that there is an actual gain by letting the water on the wheel under a head of less than 27 inches, even at the expense of having to overcome its inertia by impulse: for if the water is let on the wheel under a head of 27 inches, it is acknowledged there would be a loss of 27 inches of the power, even if it could be let on in the required direction. It becomes then a problem worth investigating, at what point it is best to let the water on the wheel, provided the wheel must move with a velocity of 12 feet a second.

I find by making the calculation, that the difference of the loss of power will not amount to two inches in the different heads from three to fifteen inches, and that the maximum is when the water is let on under a head of about nine inches, when the whole loss of power would be 22 inches.

If it were possible to let the water on in the direction of the tangent, the maximum would be under a head of 6¾ inches; for under this head it would issue with a velocity, in the required direction, of six feet a second, and immediately upon striking the wheel, it would receive an additional velocity of six feet, which is due to a head of 6¾ inches; and in this case the whole loss of power would be only 13½ inches, when there would be a loss of 27 inches if it should be let on under a head of 27.

These calculations are made on the supposition of the writer, that the water is received on the wheel at the instant of passing through the gate, which, however, is not the fact; for the lower part of gate No. 1, is 19½ inches below the head, and the water cannot be said to be on the wheel above this point so as to operate on it by gravity.

The *middle of the* gate is 15¼ inches below the head, which gives a *velocity of* 9¼ *feet* per second, or about 6¾ in the direction of the *tangent;* therefore the water on striking the wheel immediately receives an additional velocity of 5¼ feet, which is due to a head of 5¼ inches, which being added to 19½ gives the whole power lost 25¾ inches.

This is nearly 26 per cent. of the whole power, and this being added to the 57 per cent. effect before calculated, gives 83 per cent. of the power accounted for; therefore there remains 17 per cent. of the power for waste, friction, and inertia.

By inertia I mean the force necessary to put the water in motion when it is retarded at the bends of the tube. If we suppose, that all the retardations which it experiences amount to one complete stop, the loss of power is to be calculated from the velocity of the water in the tube; this velocity is two feet and one-sixth per second, which is due to a head of one inch, or nearly one per cent. of the whole power. If the velocity in the tube were double, the loss of power would be four times as great for one stoppage, and in general the loss of power from inertia is directly as the number of stoppages multiplied by the square of the velocity.

J. P. Espy.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

An inquiry into the probable influence of the Dew Point upon Health.

By James P. Espy.

It appears by the meteorological journal for December, that the "dew point" has been very low, its mean for the whole month, being 10° Fah. ranging from 4° below zero to 28° above.

Whether the influenza, which has prevailed during that period was caused by the extreme dryness of the air, and consequent rapid abstraction of moisture from the lungs, can only be determined by numerous observations. It is not unreasonable to suppose that some effect is produced on the human system by the great difference in the quantity of vapour exhaled from the lungs at different "dew points." It is the prerogative, and I may add, the duty, of the physician, to investigate what that effect is. Having the subject before me only as a meteorologist, I shall not encroach upon that prerogative; yet as "the sciences are of a sociable disposition, and flourish best in the neighbourhood of each other," I hope what I have to say, will aid, as well as stimulate, the physician, to investigate the phenomenon, as connected with health and disease.

I shall proceed to show that 5446 grains, (about three-quarters of a pound avoirdupois,) of water, are evaporated from our lungs in twenty-four hours, when the dew point is 0°, more than when it is 74°, the highest it rose during the summer.

According to the latest and most approved experiments, a man, at a mean, makes twenty inspirations in a minute, drawing in forty cubic inches of air each time, therefore the number of cubic inches inspired in a day will be 1152000. Now, when the dew point is zero, according to the experiments of Gay Lussac and Dalton, 1152000 cubic inches of air, contain 518 grains of vapour. This, therefore, is the quantity that enters the lungs in a day with the air inspired. If this quantity be subtracted from the whole quantity expired, the remainder will be the quantity actually evaporated from the lungs.

The dew point of the breath at all seasons, as any one may know by breathing on a tumbler of water, is 94° of Fah. and the number of grains of vapour in 1152000 cubic inches of air, when the dew point is 94°, is 10828. Subtract the 518 grains which are inspired from the 10828 expired, and the remainder, 10310 grains is the quantity actually turned into vapour in the lungs, when the dew point of the atmosphere is zero; equal to 1.473 pounds avoirdupois.

Again, when the dew point in the summer is 74°, the 1152000 cubic inches of air, which are inhaled in a day, contain 6004 grains of vapour; but as the dew point of the breath in summer is the same as in winter, namely 94°, if we subtract the 6004 grains inspired, from the 10828 expired, there will be left 4824 grains, the actual quantity turned into vapour in the lungs when the dew point of the atmosphere is 74°, and this, as was mentioned above, is 5446 grains less than the quantity evaporated when the dew point is zero, and is a little more than three quarters of a pound avoirdupois.

It will be seen also, by examining the calculation made above, that the quantity of moisture taken into the lungs in a day by inspiration is nearly twelve times more when the dew point is zero, than when it is 74°. The exsiccating power of respiration in the former case must be very great.

The refrigerating power of respiration due to vaporization alone in the lungs, may be thus estimated. It is known by experiment that water, at all temperatures, absorbs one thousand degrees of Fah. in turning to vapour, and that ice, at thirty-two, absorbs in melting one hundred and forty degrees; therefore if the 1.473 pounds of water which are evaporated from the lungs when the dew point is zero, be multiplied by one thousand, and the product be divided by one hundred and forty, the quotient will be ten; the number of pounds of ice at thirty-two which would be melted in a day, by the caloric given out by the lungs employed in vaporization alone; a quantity which would be sufficient to raise 15¾ pounds of iron from zero to 800 of Fah.

If to this be added the quantity of caloric given out by the lungs in heating 1152000 cubic inches, or fifty two pounds of air, employed in respiration per day, from 55 to 98, supposing the capacity of the air expired the same as of that inspired, viz. 0.26 of that of water, it will be sufficient to raise four pounds of iron from zero to 800° Fah., amounting in all to 19¾ pounds.

As the experiments, however, on the capacity of air expired from the lungs are not decisive, the latter calculation can only be considered hypothetical.

If the capacity of the air expired, as Dr. Black thought, is greatly less than that of the air inspired, caloric might be given out from the air in respiration; but later experiments do not confirm this theory.

When the air is extremely dry, which it must be when it is extremely cold, may it not be important to our health to guard against its drying influence on our bodies, by evaporating water in our parlours?

May not the pernicious influence of those winds which blow over the dry sands of Arabia, be caused as much by their dryness, as by their heat?

Why does the camel, when he feels the withering influence of those winds, thrust his nose down in the sand? May it not be, in part, to obtain a moister air to breathe, as well as to avoid the fine sand carried in the wind? If so, the traveller might obtain security by breathing through a moistened sponge.

How is the economy of nature to be explained in causing us to evaporate more moisture from the lungs in winter than in summer? Or is it intended that we should raise the dew point in our parlours as we do the temperature, by artificial means?

These questions can only be answered by a long course of experiments, but the solution will amply reward the most patient investigation.

J. P. Espy.

FRANKLIN INSTITUTE.

Extracts from the Report of the Judges appointed to examine the Cotton Goods deposited at the Seventh Exhibition of the Franklin Institute in October,* 1831.

The display of prints this year, although not extensive, was sufficient to show that this important branch of the cotton manufacture is steadily improving, and promises ere long to rival the best productions of foreign markets. Calicoes were exhibited from the different establishments of Andrew Robison, *P.*, Everett & Goddard; the Merrimack, Taunton, Fall River, and Eagle Print Works. The quality of the goods manufactured at several of these concerns is too well known to require the special and particular notice of the committee, and they therefore remark generally, that the colours appeared to be good, and the printing executed with neatness and accuracy. The dark chintzes exhibited by the Merrimack Company were much admired for their style and beauty; but the committee were of opinion that the premium should be awarded to those of Andrew Robison for their fineness, colouring, and elegance of execution.

The two blue prints from the Eagle Works, *P.*, were the best and finest exhibited, and the committee consider them entitled to the premium offered by the Institute for this article.

Of furniture chintzes there was a deficiency in the quantity exhibited, but the samples from the Merrimack Manufacturing Company were sufficient to show that with the same taste and skill which they display in their other fabrics, they may also excel in this article.

The committee pass over the sheetings and shirtings from the manufactories of J. & B. Marshall, Philip Allen, Slater's steam mill, Robert Rogerson, and J. Fisher, with the remark that the samples generally were creditable to the makers, but that if any preference is to be given, it should be awarded to the Messrs. Marshall for the evenness, regularity, and excellence of their fabrics.

Samples of cambric muslins were exhibited from the Rockland Manufacturing Company, J. & B. Marshall, and Philip Allen. The

* In publishing extracts from the reports of the judges appointed at the last exhibition, the committee on premiums and exhibitions desire it to be understood, that the gentlemen whose names are attached to the several reports, are alone answerable for their contents. The committee have, in almost all instances, adopted the suggestions of the judges; in a few cases, however, information that was in their possession, from other sources, has induced them to alter or omit some of the decisions. In such instances, the committee have acted upon their own responsibility, and in all cases, without any intention to cast the least slight upon the judges, whose able, kind, and disinterested discharge of arduous and responsible duties, is fully appreciated by the committee, as well as by the Institute and by the public at large. It will be no cause of surprise if a few expressions of individual opinions, somewhat inconsistent with the general views of the Institute, should occasionally be found in reports necessarily drafted in the hurry of a crowded and highly popular exhibition, by gentlemen, some of whom not being members of the Institute were but imperfectly acquainted with its peculiar objects. The letter *P.* indicates the award of a premium; those of *h. m.* of an honorary mention.

Institute, aware of the importance of encouraging the manufacture of this article, offered a premium for the best sample of $\frac{5}{4}$ cambrics made of yarn from No. 40 to 120, but the committee regret that the quality of those exhibited did not, in their opinion, entitle them to the premium.

Checks were exhibited by the Pennsylvania Institution for the Deaf and Dumb, by A. Clegg and James Rennie. These samples were all of good quality, and their colour the best indigo blue; but in point of beauty, fineness, and finish, a piece manufactured by C. Vancourt, (*h. m.*) one of the pupils of the Institution aforesaid, was deemed worthy of special commendation.

Of tickings the exhibition was not large. Samples, however, were noticed from the manufactories of J. Stetson, the Taunton and the Assanpink companies, all of which were good of their grades, and creditable to those who made them.

The manufacture of Canton flannels, both white and coloured, is annually increasing, and as it consumes a large portion of the raw material, the committee deem it worthy of particular encouragement. They were pleased therefore to find that the Institute had offered a premium for this article, and having examined the samples made by the Blockley Works, *P.* Dennis Kelly, John Waters, and Joseph Ripka, they recommend that the medal be awarded to the former.

Of coloured cambrics, a considerable quantity of which is now annually consumed, no samples were exhibited except from the manufactory of Joseph Ripka. His black cambrics were beautiful specimens of this article, but the pinks, and other colours, were deficient in brilliancy, and in this respect inferior to the imported.

In pursuing their examination of cotton goods, the committee observed with much pleasure several samples of canvass from the manufactory of John Colt, *P.* the character of which, for strength, durability, and usefulness for maritime purposes is now well established, and is eminently deserving of public encouragement.

Samples of ginghams were exhibited from the manufactories of J. H. Roe, Jno. Steel, *P.* and Huster & Buchanan, which, although evincing a state of improvement in this branch of the cotton manufacture, are yet far behind those imported from abroad. The committee are of the opinion that Mr. Roe's samples are the best, but the quantity not being sufficient to entitle him to the medal, they recommend that if it be awarded at all, it be given to J. Steel, whose exertions as a manufacturer deserve encouragement.

The American nankeens manufactured by Collet & Smith, *P.* from cotton produced on the plantation of J. Forsyth, *P.* of Georgia, were examined with much pleasure, because their colour is said to stand the severest tests, and in that case they bid fair to become an excellent substitute for the India nankeens.

Samples of cotton drawers and hose, made by the Newburyport Hose Manufacturing Company, *P.* being the first of the kind exhibited here in any quantity, claimed the special notice of the committee, as being substantial and well made, and as constituting another branch of cotton manufacture in this country.

Of cotton counterpanes a description of goods of which large quan-

tities are annually imported, and the manufacture of which, therefore, in this country, should be specially encouraged, but few samples were exhibited. Those manufactured by William Robinson were of good quality, and the one exhibited by Miss Richardson was a handsome specimen of female ingenuity.

The Britannia handkerchiefs exhibited by J. F. Simmons were handsome samples of our improvement in this branch of manufacture, but not being square are liable to the objection so often urged against those which are imported, and are therefore precluded from receiving the premium which had been offered.

The committee believing that the establishment of manufactories for cotton goods in the southern states will promote their interests, were much pleased to observe samples of blue brochelles, made at Richmond, in Virginia, by Cunningham & Anderson, *P.* These goods are well calculated for cheap wearing apparel, and being stout and well made will supply a desideratum.

The Marseilles vestings from the Rockland Manufacturing Company, although coarse, are worthy of notice as being the first of the kind exhibited at the Institute, and as affording an earnest of greater improvement in this species of manufacture.

Samples of Rouen cassimeres, cotton diapers, and fancy curtain muslins, were exhibited by Joseph Ripka, whose skill and enterprise as a manufacturer of various descriptions of goods, are too well known to require any special notice from this committee.

The jaconet handkerchiefs made by J. Smithurst, *h. m.* are entitled to encouragement, but if his exertions were applied to the production of a finer article, they would be more likely to be crowned with success.

As connected with cotton goods the committee beg leave to express their approbation of two copper rollers, designed for calico printing, from the manufactory of Messrs. Merrick & Agnew, and one from the shop of Mr. M. W. Baldwin. These gentlemen are well known as mechanists, and the different articles of their manufacture, the committee believe, are among the best made in the country.

In concluding this report, the committee cannot but regret that its length, already too extended, prevents them from noticing particularly several quilts, bed spreads, shawls, and other articles, the production of female skill and ingenuity, which were much admired for the beauty and taste displayed in their fabrication.

Jno. B. Trevor,
William Norris, jr.
Geo. L. Oliver,
Durden B. Carter.

Extract from the Report of the Committee on Woollens.

The undersigned, a committee of judges appointed by the Franklin Institute to examine and report upon such woollen goods as should be deposited at their Seventh Annual Exhibition, with a view to award to

those deserving of them the premiums offered in their printed circular, make the following report, viz:

No. 237. Four pieces blue satinets, from the Rock Manufacturing Company, deposited by Hacker, Brown & Co., the only lot of blue satinets exhibited; these are a very superior article, and an excellent specimen of the perfection to which this manufacture has been brought. The committee feel somewhat surprised that there should have been no competition for the premium on this article, knowing as they do, that there are many other manufacturers who produce the same description of goods.

No. 188. (*h. m.*) Five pieces mixed satinets, manufactured by Houston & Greene, Groveville, deposited by the makers. We consider this the best specimen of the article exhibited; the mixtures are remarkably well done; the fabric is strong and well cleaned from all impurities and imperfections.

No. 216. The eight pieces mixed satinets from the factory of S. Shove & Co., deposited by J. & M. Brown & M. D. Lewis, are of stout fabric, and show a handsome variety of colours. We observe no particular improvement in their manufacture; they have always had a fair reputation in the market, which is fully sustained by the lot now exhibited.

No. 397. We noticed one piece of olive satinet made by N. E. Russell & Co., Greenfield, Massachusetts, deposited by Fales & Lathrop; it is a good specimen.

There were no satinets exhibited to obtain the seventy-first premium on the printed circular.

No. 91. One piece blue cloth, No. 9168, 22¼ yards, not stated where, nor by whom, manufactured;* it is a fair specimen of well dyed and well finished cloth, and the best piece exhibited.

There were three pieces of black cloth exhibited of nearly equal value to the blue, but with nothing in their finish or fabric deserving of particular notice.

No. 101. Three pieces blue cloths from the Salmon Falls Manufacturing Company, deposited by C. C. Haven, and labelled at $3 per yard; this is a stout fabric and pretty well finished article, but as we understand cloths are declining in value, it appears that this is made of coarser wool than should be put into cloths of that value, even at the present advanced price of the material; the colouring in some of the pieces is imperfect; this was the only specimen offered at the price.

No. 110. Two pieces fancy coloured cloths, 30¼, deposited by Lewis & Whitneys, manufactured by the Great Falls Manufacturing Company. These were well made and handsomely coloured and finished; we consider them a handsome specimen of American cloth, and deserving of notice—we did not see any other fancy cloths worthy of particular observation.

No. 23. *P.* One piece exhibited out of a parcel of ten pieces mixed cloth, from the Oxford Manufacturing Company, deposited by C. C.

* Since ascertained to be by the Glenheim Manufacturing Company; it was deposited by C. C. Haven.

Haven, said to be of American wool, it is the best specimen of cloth we were called to notice, and will vie with any of foreign manufacture as to texture, finish, and mixture, in all of which it bears ample testimony to the skill and ability of the maker.

No. 143. Three pieces Rouen cassimere, cotton and wool, from the well known manufactory of Jos. Ripka; this is a superior article of the kind, and deserving of notice.

No. 111. *P.* Five pieces merino cassimere, manufactured at Lowell, Mass. by the Middlesex Company, made of cotton and wool, in imitation of the British article of same description; we consider them the best specimen of men's summer wear exhibited; they are in every respect equal to the imported article, and we are highly gratified to witness the great perfection both of texture and finish, as well as the superior style of putting up, exhibited in this lot, which we think deserving of every commendation.

No. 141. *P.* One piece green summer cloth, cotton and worsted, manufactured by Joseph Ripka, *the only imitation of the English of this description we have ever seen;* we think the manufacturer deserving of especial commendation and notice, as well for this particular article, as for his manufactures in general, which stand deservedly high in all the markets of the union.

No. 53. *P.* Four pieces white gauze flannels, manufactured by J. & T. Kershaw, Blockley, Pennsylvania. This is the finest specimen of American gauze flannel which has ever come under our notice; the wool is of the finest description, and the goods are remarkably well made, but they show rather a bluish tinge in the colour, which should be obviated in any future manufacture of the article; we could not ascertain whether the wool was American or foreign.

No. 22. *P.* We noticed with much pleasure the great variety of flannels from the Salisbury Manufacturing Company, deposited by C. C. Haven; they exhibited all the different kinds and qualities made by this company, and show a decided improvement in their manufacture, *we consider them in every respect equal to the imported article,* and entitled to especial notice; the scarlets were particularly brilliant and rich in colour.

There was not a single piece of baize exhibited, we know that this article is extensively manufactured, and are surprised that there was no competition for the premium. These remarks will also apply to drab cloths, of which there was no specimen exhibited.

No. 24. *P.* Two pair white Mackinaw blankets from the Buffalo Manufacturing Company, deposited by C. C. Haven; it is the only parcel of this article exhibited; it is a fair specimen, and shows the ability of the manufacturer to make a blanket which will in all respects compete with the foreign article; it is a branch of trade deserving of encouragement, and although we do not perceive any particular improvement in this specimen over others which we have seen in previous years, yet we cannot withhold our assent to its superior quality.

No. 469. (*h. m.*) The same remarks will apply to the other parcel of blankets, called "bed blankets," from the same manufactory; this is a twilled article, and we think *equal to the best English blankets.* We

have again to express our regret that there was no competition for the premium offered for this description of goods; and also that there was no exhibition of common point and bed blankets, an article of such general use, and one almost of necessity.

The foregoing are all the articles of woollens which have come under our notice worthy of particular observation, we have bestowed upon them that careful attention and examination which their merits severally deserved and required; the impartial result of which we have now laid before you.*

THOMAS ROBINS,
JOHN SITER,
W. WURTS,
JAMES BOGGS.

Extracts from the Report of the Judges on Silks and Lace.

The committee on silks and lace, report:

That they have examined the several lots, or parcels, of silk, included in the late exhibition, and present the following as their judgment in regard to the object of their appointment.

The committee cannot refrain from expressing their deep regret at the limited display of silk which has been made; the more so, as not a single lot comes within the list of premiums.

The specimens of manufactured goods deposited by J. Ripka, and the several lots of thrown silk represented by the Nos. 447 a 449, inclusive, also deposited by him, are deserving of particular notice. The piece of black plush, (No. 146, *h. m.*) which it is believed is made of American silk, is a beautiful manufacture, and superior to the piece of drab, (No. 361,) made out of imported silk. Of all the articles to which the attention of the committee was drawn in the discharge of their duty, this piece of goods seemed to claim a preference; whether the quality of the silk, the excellence of the manufacture, or the colouring, &c. was considered, there was found ample cause to applaud the hand that had been so successfully employed in producing an article which might well compare with most, if not all, that the committee has seen of European manufacture.

In relation to the silk prepared for weaving, alluded to in the preceding, the committee are not so well acquainted with the nature of silk in that state as to speak of it in the same confident manner.

The sewing silk and riband, Nos. 59 and 60, which are represented to have been manufactured at the Shaker village, in Mercer county, Ky. are very good. The former is an excellent texture, well coloured, and possessing a fine lustre. It is decidedly the best specimen of the kind that we have yet seen exhibited. The piece of riband is also

* Col. Jno. E. Colhoun, of Pendleton, S. C., sent two blankets made at the manufactory lately established by him on his plantation; they were delayed at sea, and not received till the last day of the Exhibition; but having been examined, after this report was drawn up, were found worthy of receiving a silver medal. Those blankets have a cotton warp and a woollen filling.

the best that we have ever seen of American manufacture. Lot 57 is deficient in quality and colour. Lot 363, also of sewing silk, is a good colour, but uneven texture, and not strong.

Lot 330, piece of black silk vesting, is made from imported silk, the quality is fair. Lot 275, samples of silk hose, are good quality, but made from imported silk.

The other articles do not claim special attention, excepting the cocoons, and the committee can only add their expression of pleasure in seeing so interesting an evidence of the adaptation of our country to the culture of the mulberry and raising of the silk worm. The committee have been much gratified in viewing the parcel of cocoons deposited by Mr. Duponceau, and which were produced upon the farm of the Hon. H. Bry, Monroe, Louisiana.

The cocoons from worms fed on the new species of Mulberry, which were received from Mrs. Parmentier, Brooklyn, L. I. are very fine; the silk is of good texture and soft.

Lot 58. One box cocoons from worms fed on native mulberry, from Mrs. Dinsmore, Cincinatti, Ohio. The cocoons are hard and firm, but the silk is not so fine and soft as the other specimens.

No lace goods being exhibited, the committee have nothing to say respecting that part of their commission.

Respectfully,
CALEB COPE,
R. COLHOUN SEE.

Extracts from the Report of the Judges on Hardware.

The committee of judges on hardware respectfully report:—

That they have attended to the duties assigned them, and now offer to the consideration of the managers their observations upon the various articles belonging to their department.

No. 1. *P.* The handsome specimens of Britannia ware from the Taunton works, are well worthy of particular attention; the quantity exhibited, and the workmanship of the article, together with its silvery appearance, display in bold relief, its near approach to the more costly metal.

No. 44. An iron candlestick, a good substantial article, will compare with the English both in quality and price.

No. 68, is a number of sad irons, from Arnold & Bacon, Rhode Island; these are good wares, possessing in a great degree the qualities which have distinguished the celebrated Colebrookdale Company's English irons.

No. 69. The cast iron vices were noticed in the last report; it was then remarked that trial alone would enable us to come to a proper conclusion as respects their being merchantable; sufficient time has not elapsed to make them generally known.

No. 70. Specimen of wire appears of a good quality, but as the quantity is small, being about two pounds, and as two hundred pounds

are required to be exhibited to obtain the premium, it must be passed by without further notice.

There are several specimens of japanned ware, which though exhibiting the fact of an ability to manufacture this description of goods to a great extent, still lack the fine finish of the English article.

The edge tools from Springfield, Massachusetts, are certainly goods of a very superior make and finish, and though the maker has to obtain for them a high price, we understand he is not enabled to supply the demand. Dunlap, Madeira & Co. have exhibited samples of their edge tools, which, though not entering into a comparison with the Springfield goods as respects fineness of finish, are a very merchantable article, and we have reason to believe them to be of a good quality. The locks made by Day & Shawk, (*h. m.*) and by M. Kates, (*h. m.*) have been noticed in a former report; but the year which has passed has given to some of the committee an opportunity of testing their quality in the using; they have established an incontestible evidence of their superiority over any other kind of lock ever imported into the country. There is, however, room for improvement in the lackering. The screws from Phillipsburg are merchantable goods, but have not yet established such a reputation as to fully compete with the English. The samples of bell metal kettles exhibited show that the article can be made, but a great improvement must take place in the weight as well as finish, before it takes the place of the English article. The planes display good workmanship and improvement over those formerly exhibited, but the irons being English, it cannot be called exclusively an American article. In approaching the button department, your committee cannot but express the pleasure derived from viewing the beauty and variety of specimens exhibited by the *enterprising and spirited* makers, J. M. L. & W. H. Scovill, (*h. m.*) and Robinson, Jones & Co. (*h. m.*) This department fully exhibits the *power* and *force* of American industry when properly protected; they have almost wholly excluded the English article from the market, making a home market for the consumption of a part of the most valuable of metals.* As it is, we believe them to be unrivalled in all the qualities which constitute a manufactured article, and too much praise cannot be bestowed upon the goods as exhibited by the above named makers. Your committee cannot think of eulogizing one in particular when so much is justly due to the other; they therefore submit to your consideration the propriety of your particularly noticing both. The few samples of pearl buttons exhibited are good articles, and would compare with the English in quality. There were a number of other articles exhibited in this department, such as saws, shovels and tongs, &c. &c. but as they have been noticed *before*, your committee deem it unnecessary for them to say more, than *that* such improvement is evidenced, as must ever be the case in a *happy* country. In closing this report, your committee must express *their* gratification at the handsome manner in which the

* The great improvement within the last year has given them the most permanent footing.

enterprising manufacturers in this department have stepped forth to enrich the seventh exhibition of the Franklin Institute.

Respectfully,

Jno. Goodman,
Geo. Handy,
Allen R. Reeves,
Thomas C. Price,
Geo. Abbott.

Report of the Judges on Philosophical Apparatus.

The committee on philosophical apparatus report, that they have examined the different articles submitted to them. They regret that no article competing for either of the premiums for mathematical and philosophical instruments, was offered. They were struck, however, with the beauty of execution of a self-registering thermometer, (for heat) made and deposited by J. Fisher, (*h. m.*) of Philadelphia. A surveying instrument, by W. J. Young, also attracted attention for its general usefulness and neatness of workmanship.

The committee would respectfully suggest as a matter of record, the providing a premium for accurately made thermometers, self-registering, as well as those of the ordinary kind, suitable for meteorological observations.

Hartman Bache,
A. D. Bache,
Jos. Roberts, Jr.

Philadelphia, October 6, 1831.

Supplementary Report from the same.

The committee on philosophical apparatus beg leave to make the further report, that among the articles coming within their province, was one not placed at the exhibition until after their first report. The article referred to is a balance of the most delicate kind used by apothecaries, made by J. Marshall, (*h. m.*) of this city. The nicety of performance of this instrument, and the thorough neatness of its parts, render it highly worthy of notice. It has, when loaded with an ounce avoirdupois, proved, in the hands of the committee, to be sensible to less than the one-fiftieth part of a grain. The beam of this balance is eight inches in length, and of brass, the suspension knife-edge playing upon a concave curve of steel: the suspension of the scale hooks also knife-edge, the hooks being of steel. The scale chains, and uniting hooks, are of silver. The index is above the axis of the beam, and the adjustment made visible by the coincidence of the point of the index with a brass stem fixed above it. The stand of the balance is brass.

In recommending this instrument to notice, the committee would suggest the propriety of offering such encouragement to the manufacturers of balances of this sort, as well as of the more delicate kind for philosophical purposes, at a future exhibition, as shall tend to cherish this useful branch of manufacture.

Hartman Bache,
A. D. Bache.

Philadelphia, October 11, 1831.

Extract from the Report of the Judges on Stoves and Grates.

The committee of judges upon stoves and grates beg leave respectfully to report, that they have paid great attention to the important and interesting duty assigned to them, having witnessed the daily trial of such of the coal stoves adapted to culinary purposes, as the makers or depositors were desirous of exhibiting in actual operation.

Nos. 13 and 14. Two sheet iron cooking stoves, made by Mr. Estlin, were found to bake well; they require a small quantity of fuel, and are well adapted to warming the apartment, but are not considered durable, or convenient for boiling or washing.

No. 206. A sheet iron cooking stove deposited by Mr. Lange, is considered excellent, for baking cakes and pastry.

No. 383. A cooking stove, made by Mr. Steinhauer, is considered very economical, and is much liked by a number of families who have used it.

No. 463. A small cooking stove, deposited by Messrs. Steinhauer & Kisterbock, is considered the most economical and convenient apparatus hitherto presented to the public at a low price, and one by which the poor may take advantage of the safety and economy of using anthracite, heretofore almost exclusively confined to the rich. This apparatus costs about six dollars, it bakes and boils well, is convenient for washing and ironing clothes, and is well adapted to warming the apartment. One ton of fine coal, costing three dollars, will supply it with fuel for four months, using it fourteen hours each day. The committee respectfully recommend that a silver medal be awarded to the inventors for the above apparatus.*

No. 19. A cooking stove made by Mr. J. J. Hess, deserves great commendation for the compactness and number of its culinary fixtures. The oven baked well, but very slowly, and the quantity of fuel consumed appeared to be too large. The boiler for washing is too small for ordinary families.

No. 205. A cast iron cooking stove made by Mr. A. A. Young, is very neat and compact, and will be durable, but it is objectionable from the arrangement of the grate, allowing, (without considerable care,) the products of combustion to enter the room. This stove has two ovens, and the ordinary kettles of a family are intended to be used upon it for boiling, &c.

No. 534, *P.* A cast iron cooking stove, made by Mr. Stackhouse, is very neat and compact, and will be very durable. It bakes and boils well, and the whole arrangement is good. The fixtures are

* The committee on premiums and exhibitions, after maturely considering this subject, determined to recommend to the Board of Managers in no manner to sanction any stove or grate, in which the fumes of the fuel should come into contact with the victuals intended to be cooked; their recommendation was adopted by the Board. This explanation is given in order to account for the withholding of the silver medal, and with a view to prevent the inference from being drawn, that the Managers had changed their views on this subject; as at present advised they think it proper to adhere to their former decision, in no manner to lend their sanction to stoves or grates constructed on that plan.

well made, and consist of a large tin boiler for washing, a tin boiler and steamer for meat and vegetables, and a tin tea kettle, to all of which *copper* tubes are attached, which pass through orifices made in the sides and back of the stove, over the fire, and from which an abundance of heat is communicated to the contents of the several vessels. Under the grate is a convenient permanent sifter, to separate the ashes from the coal. The stove, now exhibited, weighs 2 cwt. 2 qrs. 8 lbs; the price twelve dollars, and with the fixtures eighteen dollars; but Mr. Stackhouse has offered to furnish them weighing 1 cwt. 2 qrs. 0 lbs. with the fixtures as above for fifteen dollars, and the committee being informed that the latter will be as heavy, and consequently as durable, as the cast iron stoves ordinarily used, they are of opinion that this stove combines greater advantages than any other now in use, and although the price is not "under fifteen dollars," yet they respectfully recommend that the premium of one hundred dollars, and a silver medal, be awarded to Mr. Stackhouse for the same.*

The committee remark generally, that all the grates of stoves should be adapted to the burning of *small* coal.

The soap stone grates made by Mr. Bingham and Mr. Peck, are considered very neat.

No improvement is visible in the coal grates, since the last exhibition.

MARCUS BULL,
MOSES KEMPTON,
JOHN U. FRALEY,
JNO. MINGLE.

Philadelphia, October 10, 1831.

Extracts from the Report of the Judges on Carpets.

The committee on carpeting beg leave to say, that they consider the Brussels carpeting, No. 21, (*P.*) manufactured at Carlisle, by Mr. Givan, entitled to the premium, being a handsome and durable article, and entirely of *American manufacture and materials.*

* Mr. Stackhouse says—

I engage to furnish, if ordered, fifty coal stoves, weight 2 cwt. 0 qrs. 8 lbs., of the kind exhibited at the late exhibition of the Franklin Institute, without kettles for - - - - - - - - $12 00

And one kettle with a copper tube, and boiler and steamer, -	3 00
One wash boiler with copper tube, - - - -	2 50
	$17 50
Allow me to reduce the weight (48 lbs.) of stove to 1 cwt. 2 qrs. 0 lbs., deduct - - - - - - -	2 50
	$15 00
Allow me to substitute iron boilers of the same capacity with any of the others exhibited, and the price will be reduced to - -	$14 50

The ingrain, No. 20, manufactured at Carlisle by Mr. Givan, and that manufactured by the Lowell Company, No. 5, (*P.*) we would leave to your decision, remarking that we consider the Lowell of *superior manufacture,* though not exclusively American, (the warp having been imported in the grease,) and we should not hesitate to recommend it for the premium, if it had been entirely American. The *Carlisle* is entirely American, and of an excellent quality.

The Brussels, No. 6, manufactured by the Lowell Company, we consider a splendid article,* the colours and manufacture being equal to English, and we should have considered it entitled to the premium, if it had been exclusively of American materials.

(*H. m.*) We take pleasure in recommending to your notice the beautiful piece of *painted floor cloth,* manufactured by Mr. Isaac Macauley, of this city, which we think equal in durability and beauty to the English. The oil cloths for table covers, also manufactured by Mr. Macauley, we consider superior to any imported of the same kind of goods.

(*H. m.*) Wm. Christie and Lloyd Mifflin would also recommend to your notice, the tufted hearth rugs, No. 37, manufactured by Doggett, Farnsworth & Co. which they consider much superior to any of the same kind they have ever seen of American manufacture, both for durability and workmanship.

	Wm. Christie,	*Committee*
	L. Mifflin,	*on*
October 7, 1831.	Jacob Farnsworth,	*Carpetings.*

Explosions of Steam Boilers.

Continued from p. 30.

(No. XXII.)

WITH A COPPERPLATE.

To the Committee on the Explosions of the Boilers of Steam Engines.

Gentlemen,—Believing that the greater number of explosions which take place in the boilers of steam engines, are occasioned by suffering the water to get too low in them, thereby leaving the sides and flue exposed to the action of the fire, and heating them and the steam to an unwarrantable degree, I take the liberty, (without assigning any philosophical reasons,) to offer the following arrangements for your consideration.

1st, To regulate the quantity or height of water in the boilers at all times, whether the engine is in motion or not.

2nd. To regulate the pressure of steam in the boiler, or to prevent a greater increase of power than is required.

3d. To detect the incorrectness of the safety valve, and the negligence of the engineer; also to give notice should any thing be wrong in the boilers.

4th. To indicate the temperature or relative heat in the boiler.

5th. To enable the engineer to clean the boilers, in a great degree, at any time, without the necessity of stopping the engine.

6th. To prevent the water from flowing from that boiler which becomes the highest, in consequence of the boat being careened, or out of level.

7th. To scrape or remove obstructions in the supply pipes, while the engine is at work.

Description of the Plate.

1st. To regulate the quantity of water.—A, is a small reservoir containing mercury. B, is a small cylinder attached to A, in which is a piston. C, is a part of the flue E, so arranged as to admit the fire to act on the bottom of A; the operation then will be that as the water settles, the top of A becomes uncovered by water, consequently the heat is not carried off so fast, and the expanding mercury forces up the piston and gives motion to lever D; which, by its connexions, as shown by the drawing, raises the stop stem F, which allows the valve G to rise, and admits the water into the forcing pump H; the motions are reversed when the water arrives at the proper height, as shown by the line I; by covering A, the temperature of the mercury is reduced, so that the piston descends, which causes the stop stem F, to approach nearer to the valve G, so as to prevent the valve from rising higher than necessary to admit a regular supply of water. J, is a weight placed on the stem of the valve K, so that the engineer can at all times tell when the pump is in working order, by the motion of the weight up and down, for should any thing be the matter with the pump, the weight will be stationary.

2nd. To regulate the pressure of steam, &c.—L is the common safety valve loaded to the pressure desired; the steam being at that height, the mercury is poured into the reservoir A, until it rises to the proper height, as, for instance, to about the position in which the piston is placed in the drawing; the operation then will be, should the safety valve be overloaded by carelessness, designedly, or accidentally prevented from working, the mercury will rise by the increasing heat of the increased pressure of steam, as well as if the water had been below the top of reservoir A. By the raising of the piston, the end of the lever D is made to press against the spring attached to the lever M, until it bears hard against the end of M, when the valve in N will open quickly and wide, and let the steam on to the small engine O, which is made to work the cold water pump P, to force the water into the boiler through the pipe Q; the cold water reduces the temperature of the water and steam in the boiler, until they come down to the pressure required, when the small engine will stop. To insure the starting of the engine without the assistance of the engineer, it will be necessary to load the fly wheel R, so that the crank will always stop in a proper position for starting. It would be probably better to have two small cylinders, with the cranks placed at right angles, there would then be no doubt that the engine would start as soon as the valve N were opened. From the foregoing explanation, you will perceive that the small engine will

keep the water to the proper height when the boat is stopped; the cylinder B, is intended to give notice should any thing be wrong in the boiler, whether the steam be too high, or the water too low.

3d. To indicate the temperature in the boiler, the brass plate S is graduated so that, by the position of the index T, you can see the relative heat in the boiler.

4th. To enable the engineer to clean the boilers and fill them.—It is well known that where there are heaters attached to the bottom of boilers, that all the dirt and sediment collects in them. It is also well known that those heaters burn out first, owing to the sediment being collected in them and acting as a nonconductor of heat. I therefore propose placing a cross receiver for dirt and sediment connected with the boilers, as shown by the drawing, at U, so that the fire will not act on it; there will be little or no heat lost, as it will not descend. The reason why the sediment collects in those receivers, I conceive to be owing to a continual current in the water from the fire end to the back end of the boiler, and more particularly when the supply is going on; the water at the fire end being lighter, in consequence of the greater heat, rises to allow the heavier or colder water coming from the back end of the boiler, producing a current, as represented by in the drawing, allowing the dirt, &c. to pass down the pipe connecting the boiler and receiver; there should not be more than two boilers connected to a receiver when placed in a boat, otherwise we would have no advantage in placing the supply pipes as shown in Fig 2. V, is a cock placed in the end of receiver U, by opening which the dirt, &c. will be forced through a pipe, leading to the outside of the boat under water, which can be done as frequently as you wish. Should you wish to empty your boilers entirely and refill them, the engineer will first put out the fire, leave the doors open to cool down the furnace; then, before the steam gets down, open the cock V, and let all the water out; then by forcing a small quantity of cold water into the boiler, the steam beginning to condense, the water will rush back through the pipes and fill the boilers as high as necessary, when the cock should be shut.

Fig 2.

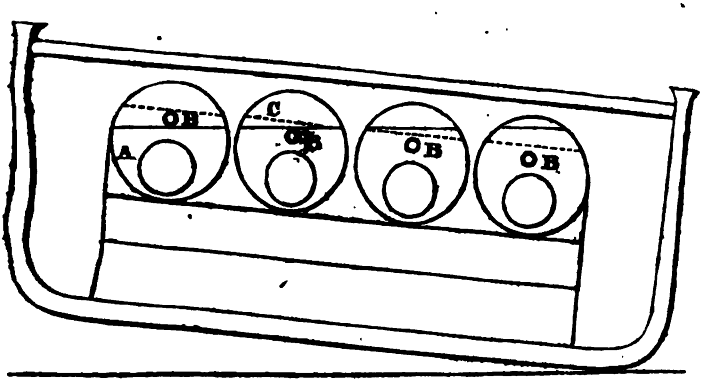
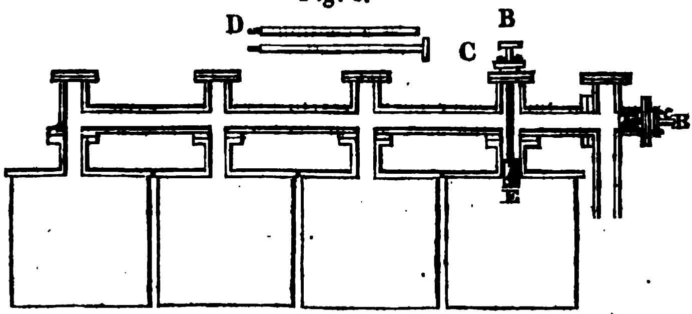


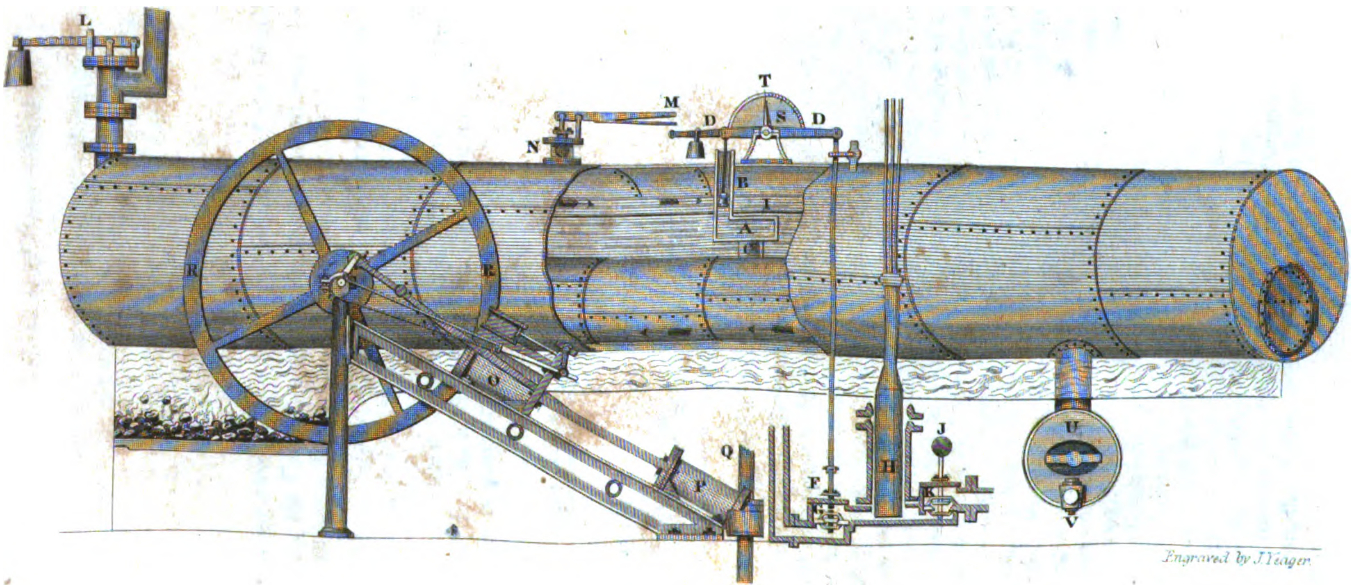
Fig. 2. To prevent the water from flowing from the higher boilers to the lower ones. A, the end view of the boilers. B, the ends of the supply pipes, placed within three inches of the surface of the water, as represented by the dotted line C, which is the position when the boilers are level. The black lines show the position of the water as relates to the boiler when the boat is careened. You will perceive that it is impossible for the water to flow below the bottom of B, let the boat be ever so much careened, or out of level. The drawing shows the pipes without valves on the ends, which would be necessary to prevent any water from flowing back; they should have hinge valves such as represented in the margin. To clean the supply pipes they should be arranged as represented in Fig. 3.

Fig. 3.



A, is a small cylinder made of sheet iron, about a quarter of an inch thick, with the ends somewhat sharpened, fastened to the stem B, working through a stuffing box, as at C. D, are connexions for screwing on the end of B. A, being forced backwards and forwards, scrapes the side of the pipe entirely clean. At E is a scraper of the same kind as that placed at the end of each boiler.

The advantages of making use of the mercurial apparatus are many, because as mercury is a fluid metal expanding by heat with a great power, it can put in motion any fixture necessary to regulate the water; to throw the water of the regular cold water pump direct into the boiler; to give notice when the steam is too high, at the same time acting as a safety valve, also to warn you when the water is too low in the boiler; to open doors placed at the ends of the flues; start the small engine; direct the cold water into the fire, &c. all of which can be done at their respective or proper times, merely by arranging each fixture to receive its motion at a particular position of the piston; as, for instance, in the regular state of the boilers, its operation is solely to regulate the valve G. Should any thing prevent a full operation of the pump H, the piston continuing to rise by the increasing heat, sets the cold water pump to throw the water directly into the boiler; should that fail, the piston still continuing to rise, starts the small engine, opens the doors at the end of



Engraved by J. Yeager.

the flues, opens the cock to give notice, and changes the direction of the water to put out the fire.

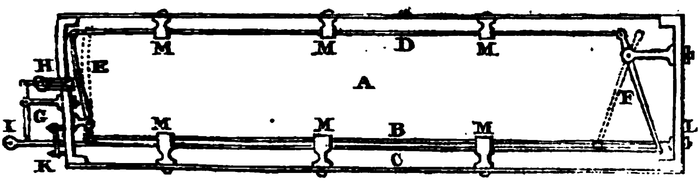
Yours, respectfully,
CADWALLADER EVANS.

Further observations for the consideration of the Members composing the Committee on the explosion of steam engine boilers, of the Franklin Institute.

Fig. 1. Expanding rods to prevent the explosion of steam boilers.

A, a ground view of a steam engine boiler. B, C, D, are brass rods of about three-fourths of an inch in diameter. E and F are levers connected to the brass rods. G, a lever attached to the valve cock H. K, a stuffing box at the end of the boiler. M, M, are guides to prevent the rods from bending.

Fig. 1.



Explanation of the principle and operation of the rods.

Smeaton, in his experiments on the expansion of metals, has found that 180 degrees of heat, will expand iron one foot in length $\frac{151}{10000}$ of an inch, and that brass expands $\frac{232}{10000}$ of an inch. Suppose the boiler to have been 20 feet in length, and the rods 18 feet: we will now suppose that rod B is secured to the back end of the boiler at L, then 232, expansion of one foot of brass, $\times$ 18 = 4176 — 151 $\times$ 20 feet length of boiler = 3020 = 1156. Expansion of rod B beyond that of the boiler, which $\times$ 13, the ratio of length of the arms of lever E, = 15028 + 4176 = 19204 the motion of the end of rod D, which $\times$ by 12, the ratio in length of the arms of lever F, = 230448 + 4176. Expansion of rod C, = 234624, the motion of the end of rod C at 1, which $\div$ by 10,000 = $23\frac{4624}{10000}$ inches. Now, as 180 degrees : 23.4624 : : 10 degrees = $1\frac{3034}{10000}$ inches, so that it appears a very small increase of temperature will give the necessary motion to open the cock H, at the proper time, it can also be applied to regulate the damper, to increase the supply of water, or to direct the water of the cold water pump immediately into the boiler; it is also evident that we are not limited in the motion of the end of the rod C, but can arrange the machine so that one degree will give a motion of three or more inches: when the boilers are made of copper, the rods should be of iron, the motion of the rods would then be reversed by increased heat.

Fig. 2.

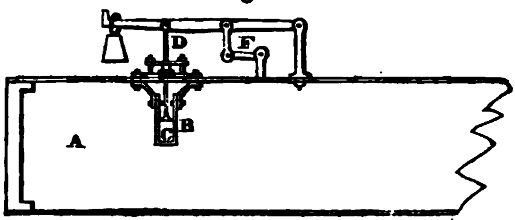


Fig. 2, represents an improved application of the fusible metal for the purpose of giving the alarm when the water gets too low in the boiler. A, the boiler. B, a small cylindrical tube. C, the fusible metal. D, a stem passing through a stuffing box, and resting on the fusible metal, the other end fastened to lever E. F, an alarm cock which opens when the rod D descends in the fluid metal, and gives notice that the water is too low. What I consider to be an improvement is the use of the cylinder, which prevents the metal from being lost, and is always ready for a new operation. I believe in all other applications of the fusible metal, it would be necessary to get the steam down, and, in some cases, to empty the boiler before the metal could be applied for another operation.

CADWALLADER EVANS.

The above drawings are not made to any scale, nor have I shown the application of the rods to all the purposes intended, as I have not time to do this at present.

(No. XXIII.)

Letter from John G. Cassedy, dated

Washington City, October 4th, 1830.

GENTLEMEN,—Aware of the magnitude of the subject upon which I intend addressing you, involving the lives and property of the citizens of our country, I will treat the subject as fully as circumstances will allow, paying due regard to that brevity so desirable in communications of this nature.

The repeated and melancholy catastrophes arising from the explosion of steam boilers, have produced in our country a general, and I hope, a beneficial, excitement, causing minute researches and investigations that may ultimately avert such awful and terrible consequences. A moment's reflection upon the recent explosions of the Helen M'Gregor, Chief Justice Marshall, and others, would, were conviction necessary, convince the most obdurate that immediate and prompt measures should be taken to prevent in future such vast sacrifices of life and property, to whatever causes they may be attributable; whether from defects in boilers, ignorance, negligence, or other causes yet unknown, the proper and efficient remedy for which, I humbly pray, may be the result of your philanthropic investigations; which, if aided by the zealous co-operation of Congress, I have not a doubt will be the case, and that in future our lives and property will be secured from such disasters.

The circular published by you, requesting information upon this

important subject received my early attention; but circumstances have, until now, prevented me from addressing you on this subject, and when it is receiving the consideration of the science and experience embraced in the Franklin Institute of Philadelphia, perhaps delicacy ought still to restrain me.

That part of the extensive subject to which I would draw your attention is the construction of the safety valve, it being in its present form, as generally used in this country, considered, and found by experience, highly defective. Against the safety valve now in use there may be urged the following objections, which the improvements I have to propose will entirely obviate.

It admits of being loaded to any extent, thereby increasing the density of the steam to any indefinite pressure, without the slightest knowledge being given to, or attainable by, any of the passengers who might take the necessary precautions for their safety. It is sometimes so placed that it can be loaded by any unguarded hand, or passenger, on board the boat; and, lastly, it is at the entire command of the engineer, offering every facility to increase the pressure when ambition or other causes might induce him to hazard the lives of the passengers for the paltry consideration of excelling in speed. I will proceed to examine these objections, stating the manner in which they can be obviated. A boiler, constructed to work upon the high or low pressure system, is regulated in its strength accordingly; each thickness of iron having a corresponding pressure to withstand, which, for a limited time, can be borne with safety. Boilers, when originally constructed, have their pressure regulated by the weight affixed to the safety valve, which, when retained in its original position, produces no more than an ordinary density of steam; though in its construction, (the weight being hung to a horizontal lever, with its fulcrum at the extreme end,) the weight admitting of being removed to the other extreme end, or from the fulcrum; thereby increasing the effect of the weight upon the valve in proportion to the leverage obtained. To exemplify this objection, I will relate an anecdote of a steam-boat captain, in the western waters. A boat had overtaken him; the steam was raised to "blowing off;" he jumped upon the safety valve, and swore he would either "beat her, or else blow up." To men so destitute of the principles of prudence, the life of an unwary passenger should never be intrusted, I therefore would place this safety valve beyond the reach of one so hazardous and imprudent. Any hand, or passenger, on board the boat, unconscious of the dangers that arise, might remove the weight from its proper position to the extreme end of the lever, thereby increasing the pressure perhaps two fold; from any such dangerous removal serious consequences must ensue.

In a momentary excitement, similar to the above instance, the captain, or engineer of the boat, might remove the weight on the lever, regardless at that time of attending dangers; while in an hour of cool deliberation he might shudder at the dangers he had escaped, and wonder at his extreme good fortune.

To obviate these general objections, arising from the dangerous alterations to which this valve is susceptible, I will explain the

construction of the valves possessing these qualities. For boilers working upon the low pressure system, where steam much above one atmosphere is impracticable, I would have a chamber, A, A, Fig. 1,

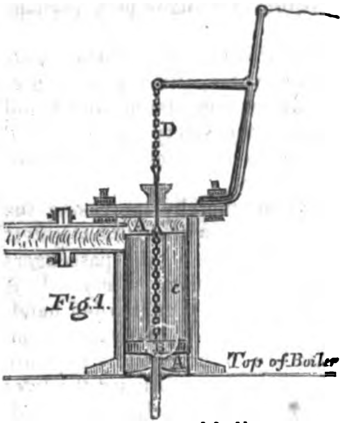


Fig. 1.

having at the bottom a seat for the reception of the valve B, (as constructed upon the ordinary principle;) the requisite load or weight c, should be cast upon this valve, fitting close into the chamber A, A, with an intermediate space only sufficient for the action of the valve; there being grooves cast upwards in the load c, as channels for the steam to escape when the valve is raised; when from the filling of the chamber with the weight or load c it is impossible to increase the weight within the chamber A, A. To prevent any weight being hung to the vertical valve rod, (as done on some occasions,) we would dispense with this rod, and substitute a chain, D, which chain, while answering all the purposes of a rod in raising the valve, will allow no additional application of weight, for a chain bearing a strain equal to its strength, will not withstand the least pressure without coiling; as would be the case with the chain D, in an attempt to load by the outward lever. The weight c is hollow, the chain D, being attached to the top of the valve. By this simple contrivance of enclosing the weight immediately upon the safety valve in a close chamber, and of having it raised by a chain, coiling the moment any pressure is applied, all stratagems of an imprudent and hazardous engineer are put at defiance; or when through ignorance he may be unconscious of the dangers he is hazarding by an increase of pressure on the valve: as thus contrived it is utterly impossible.

Another construction of the safety valve, similar in its principles and advantages, is, like Fig. 1, adapted principally to low pressure boilers.

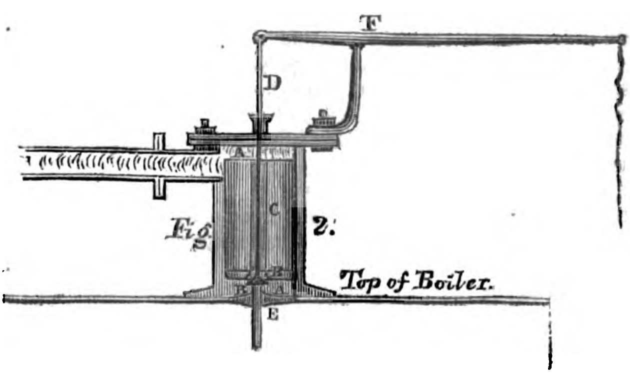


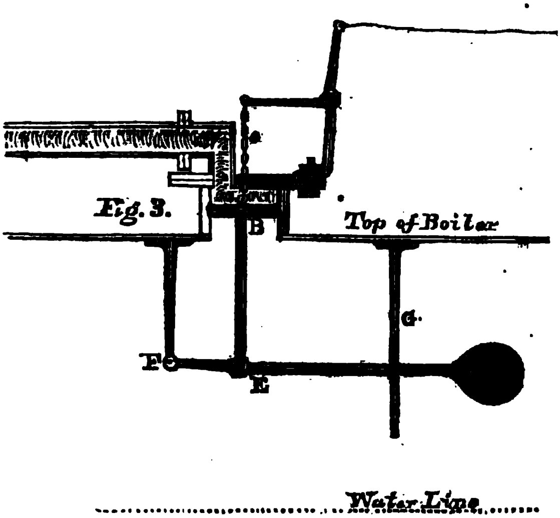
Fig. 2.

The valve B, Fig. 2, is loaded like Fig. 1, with a small hole drilled vertically through the weight C and the valve B, with a valve seat at the bottom for the reception of the small valve E, into which it works, closing upwards. When an attempt to load is made by suspending a weight to either end of the lever F, both applications are found to allow the steam to escape; for by hanging it to the short arm you depress the valve E, it opens, and the steam escapes; or if hung to the long arm, it raises the small valve, which closes and presses upwards against the large valve B, which lightens or even raises it, allowing the steam to escape. The small valve opens downwards, the large valve upwards.

From the greater weight required upon the safety valve of a high pressure boiler, it would be impracticable to load the valve upon this principle, having to extend the chamber to a considerable height or width. To prevent this, the chamber should be perfectly close, as heretofore, leaving no space for an addition of weight, with the guide extended to some convenient length downwards, as in Fig. 3, with a *joint* below to be attached to the lever E, having its fulcrum at the extreme end, F, with a lead weight, D, cast upon the other extreme end of the lever E. By this leverage of the weight, (supposing it to be quadruple,) the effect of the weight upon the valve will be quadrupled, one hundred pounds acting with a pressure of four hundred pounds in virtue of the leverage obtained.

To prevent the lever E, and weight D, from receiving a swagging motion from that of the boat, it can be admitted into a groove staunchcheon, G, secured to the top of the boiler, extending downwards; this groove of a length only to allow a sufficient rise of the valve A for "blowing off."

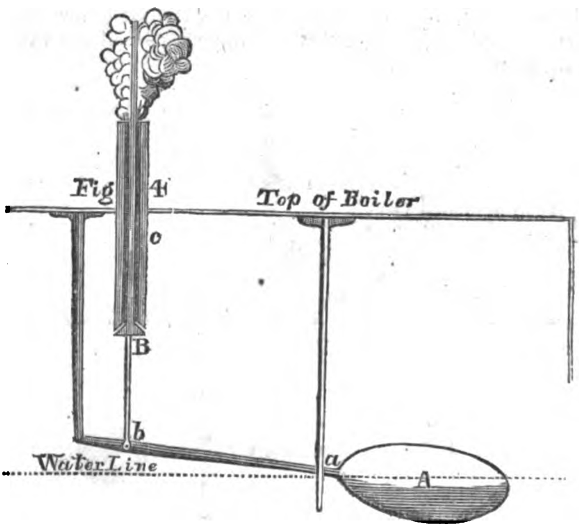
Fig. 3.



This construction of a safety valve, (intended for high pressures,) though not presenting a total impossibility of an increase of weight, still presents difficulties which are not easily overcome; nor could the slightest addition be made to the weight, for one or two days, required for the boiler to cool before any person could venture in it to make the alteration, which trouble and delay it is supposed few will take when engaged in regular trips with passengers or freight, thus preventing entirely any sudden increase of weight which a momentary excitement might prompt the captain or engineer of a boat to make, and which upon mature deliberation would be censurable even in themselves.

Scarcity of water in the boilers of a steam engine, causing in a great measure the most awful and fatal explosions, of late rendering a passage in a steamer a voyage of fear and apprehension, may be well attributed to the inattention of some of our engineers to a most necessary part of their duty, namely, that of keeping a proper supply of water in their boiler.

Every boiler is supplied with two or more gauge cocks, for the purpose of ascertaining the height of water within it. With sufficient attention paid to these, other contrivances would be superfluous; but experience in many instances has taught that other contrivances are necessary, compelling an engineer to pay sufficient attention to his gauge cocks. A plan of one I will endeavour to explain. (See Fig. 4.)



It is the application of a float, A, to the working of a valve, B, fitted and ground into the bottom of the pipe C, secured to the boiler; the valve having a guide extending through the pipe, with the

other necessary levers for its operation. When the water is at its proper height, the buoyancy of the float A, will close, and keep closed, the valve B, which is perfectly steam tight, but in the event of the water lowering to a dangerous point, the float A, by its own gravity, will descend with it, acting with the leverage *a*, *b*, brings with it, and opens the valve B, thereby allowing the steam to escape through the pipe *c*. The lever of the float A is steadied by a grooved staucheon, as described in Fig. 3.

A negligent engineer will thus receive an effective warning of his danger, demanding immediate and prompt attendance to a renewal of the requisite quantity of water, as the only means to prevent the steam from escaping.

These contrivances, if generally adopted, might afford security against a dangerous pressure of steam; if obtained by these or any other contrivances that your experience and science may recommend, I will receive sufficient remuneration for my trouble.

Gentlemen—Before quitting this subject, which has been so deeply impressed upon you and the majority of our citizens, allow me to pay a passing tribute of respect and gratitude, due from our country to your indefatigable zeal and labours in so humane a cause: the deep interest you have taken in this momentous subject, and the ability with which such a scientific investigation must be continued by you, will no doubt prove successful in preventing further sacrifices of our fellow citizens. For your unremitting exertions for the attainment of these desirable ends, you will call forth the thanks of our travellers, our citizens, and our country, whose safety and welfare you have made your study, and whose gratitude, which you merit, shall be continued as long as the beneficial results of your labours shall be experienced and admired.

Allow me, gentlemen, to conclude by offering an apology for this humble tribute which love of country has induced me to offer; should you think it worthy of perusal, my gratitude will be increasing and continual, while the suggestions of the humble may be thought worthy of consideration.

I have the honour to be,
Gentlemen,
Your obedient servant,
JOHN G. CASSEDY.

In writing this communication upon the safety valve, two of my own construction only were included, when by request of a gentleman of science, I included two of his, to whom the merit of the original idea belongs, he having called upon me to furnish drawings, &c. by which circumstance my attention was first drawn to the subject.

(No. XXIV.)

Extract of a letter from James D. Woodside, dated

Washington City, August 22, 1830.

Sir,—By an advertisement in a paper of this city, I perceive that it is the wish of the Franklin Institute to receive from individuals their ideas in relation to the bursting of boilers on board of steamboats, and if practicable to devise some plan to prevent it. I therefore do myself the pleasure to remark, that, in my opinion, though the causes of explosions are many, yet there are two which may be considered as the principal ones.

The first I shall name is defect in the metal, and the second permitting the water to get too low in the boiler. The water in the boiler should never be permitted to fall below a certain line. About three years since I devised a plan for preventing boilers from bursting, by having a safety valve within the boiler, where no one can possibly meddle with it, and so constructed as to open itself when the water has fallen to a certain depth. This valve will certainly open of itself when the water has fallen below it.

There might be a great improvement made in boilers which would very materially strengthen their ends, viz. by having them convex within, and, of course, concave without. Added to this, let bars of wrought iron be placed across the ends of the boiler, say three bars making ends to overlap the edge and support the rivets all round.

In the present mode, safety valves are placed where additional weights may be applied to keep them closed; this in a race has been the cause no doubt of many disasters. I remember to have noticed a paragraph in a Baltimore paper giving an account of the explosion of a boiler, caused by the captain's adding his weight to the lever for closing the valve, which caused the boiler to burst, and did considerable injury.

* * * * * *

Very respectfully yours,
James D. Woodside.

(No. XXV.)

Letter from E. Bigelow, dated

Washington City, September 23, 1830.

Sir,—I believe that I have found a means by which explosions may be prevented. Though there may be many causes of these accidents, I believe a deficiency of water in the boiler to be the principal one. I propose to place a pipe upon each boiler, under which is a plate of iron or copper much weaker than the boiler; this plate will give way sooner than any other part of the boiler and allow the steam and water to blow up without damage.

Yours, respectfully,
E. Bigelow.

(No. XXVI.)

Second letter from E. Bigelow, dated

Washington City, September 25, 1830.

Sir,—My first letter not having referred to a method of preventing a collapse of flues within boilers, I write again to propose that moveable braces should be placed within these flues. Such braces should not be made so large as to interfere with the draft, or with facility of removal.

Yours, respectfully,
E. Bigelow.

(No. XXVII.)

Extract of a letter from John D. Weird, of Vergennes, Vermont.

I see that there is much discussion upon the subject of the bursting of steam boilers, and that your Institute is investigating the matter, and as all sorts of opinions appear to be requested, I beg leave to offer mine as the result of no inconsiderable practical experience, although I know it differs from the opinions of nearly all the steam engine builders on this side of the Atlantic, and also from an opinion published by Dr. Jones in your journal, that steam of the elastic force of fourteen or fifteen pounds per square inch may be used with safety. My opinion is, that steam of greater force than three or four pounds per square inch above the pressure of the atmosphere can never be used without great danger, for no ingenuity can render a boiler secure against accidents, therefore security can only be obtained by using steam of such force as shall not produce extensive mischief when accidents do happen. Mr. Burr says,* "we hear of no similar explosions in Great Britain;" the reason is, that all the British "marine engines," as they are called there, are worked with a pressure of only three or four pounds per inch in the boilers, instead of the thirty-six pounds per inch used in many of the American low pressure boats. And it is a fact too that some steam engines, made by Mr. Watt forty years ago, will at this time perform more work, with a given quantity of fuel, than any that have been made since, and they are uniformly worked with the low pressure of four pounds per inch. This circumstance is certainly no argument in favour of using high steam for the sake of economy.

I am, &c.
John D. Weird.

* Jour. Franklin Institute, p. 333, vol. vi.

Franklin Institute Quarterly Meeting.

The thirty-second quarterly, or eighth annual meeting of the Institute, was held at their hall on Thursday, January 19, 1832.

Thomas Fletcher, Vice President, took the chair, and

William Hamilton was appointed secretary, *P. T.*

The minutes of the last quarterly meeting, and also the minutes of the meeting held this day at 4 o'clock, to appoint the tellers, and to open the poll for the election of the officers and managers of the Institute for the ensuing year, were read and approved.

The annual report of the Board of Managers was read and accepted, when, on motion, it was referred to the committee on publications, with instructions to publish it.

The annual report of the Treasurer was read and approved.

The amendment of the constitution, proposed at the last quarterly meeting, was called up, when the following amendment was offered, viz.

Article 2nd, section 4th. Any member who shall have refused to pay his annual contribution for two successive years, shall, by a vote of the managers, forfeit his membership; but he shall not thereby be exonerated from the payment of his arrears.

Which, after some discussion, was unanimously adopted.

The tellers appointed to receive the votes of the members, made their report, when the Vice President declared the following gentlemen duly elected Officers and Managers for the ensuing year.

President..............James Ronaldson.

Vice Presidents........Isaiah Lukens,
Thomas Fletcher.

Recording Sec.........J. Henry Bulkley.

Corresponding Sec.....Isaac Hays, M. D.

Treasurer..............Frederick Fraley.

Managers.

1. Samuel V. Merrick,	13. Thos. Scattergood,
2. Abrm. Miller,	14. Benj. Reeves,
3. Wm. H. Keating,	15. Alexr. D. Bache,
4. Adam Ramage,	16. Alexr. Ferguson,
5. Isaac B. Garrigues,	17. Joshua G. Harker,
6. Rufus Tyler,	18. John Agnew,
7. John Struthers,	19. Charles Toppan,
8. John O'Neill,	20. Geo. W. Tryon,
9. M. W. Baldwin,	21. John Wiegand,
10. Saml. J. Robbins,	22. William Wetherell,
11. Mordecai D. Lewis,	23. John B. Trevor,
12. Chas. H. White,	24. William B. Reed.

The committee on statistics reported that they had prosecuted

their preparatory duties almost to completion; the circulars and schedules were all ready for distribution.

On motion, the committee on statistics were instructed to present at the next monthly meeting a list of persons to be nominated to serve as ward committees to collect the information relative to the manufacturing establishments, &c. in the city and districts of Philadelphia.

THOS. FLETCHER, *Vice President.*

WILLIAM HAMILTON, *Rec. Sec. P. T.*

Report of the Board of Managers.

To the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, the Board of Managers respectfully submit their Eighth Annual Report.

THE termination of the eighth year of our labours invites us to a review of the general concerns of the Institute, and of the progress which has been made during that year to promote the great objects for which it was established.

Pursuing the order which was adopted on former occasions, we shall first call the attention of the members to that part of our duties which is connected with education.

This was the first object of the founders of the Institute, and must ever continue to be one of its most important departments. Another year's experience adds to the high opinion previously formed of the general fitness of the plan of instruction heretofore pursued, while the success of some new and hitherto untried projects seems to invite to further experiments in order to add to its usefulness and efficiency. The separation of the subject of practical mechanics from the chair of natural philosophy and mechanics has added to the attractions of our lecture room. The instruction delivered every fortnight by our new lecturer, Mr. Franklin Peale, has from its novelty and from the intrinsic merits of the lecturer, attracted much attention on the part of the public; the experiment, so far as it has proceeded, has given to the Board great satisfaction, and has, it is hoped, been equally gratifying to the members of the Institute at large. By reducing the very extensive field which had fallen to the lot of Professor Johnson, it will relieve him from part of his duties, and enable him to devote more time to other portions of the important professorship committed to him. Natural philosophy may be considered as the very element of all the subjects taught in the Institute's lecture room. Without a proper knowledge of it, the students will derive much less benefit from the lectures on mechanics, or on chemistry. It is therefore desirable that this science should be taught as thoroughly as possible, and that the lecturer's attention and time be not divided between too many subjects. The course of chemistry, by Prof. Franklin Bache, continues to enlist the attention of a large and respectable part of the community.

It is with much pleasure that the Board advert to the increasing interest in our lectures manifested by the females and younger branches of the families of our members. There have been issued by the actuary, 196 minors' tickets, 63 ladies' tickets, and two strangers' tickets. Including female minors, there are now 110 ladies attending our lectures, which is an increase of 44 over our number last year.

Our schools have also experienced some change in their organization, and have, we believe, increased in efficiency. The drawing school retains its usefulness, and includes at present thirty-nine pupils. The teacher of ornamental drawing, Mr. Bridport, having resigned his situation, it has been found expedient not to fill the vacancy during the present winter. The teacher of architectural drawing, Mr. Strickland, is well qualified to give instruction in all the departments, and experience has satisfied us of the propriety of having but one teacher in the same room at the same time. Doubtless, if the funds of the Institute permitted us to retain for our own use some of the apartments which are now rented, a more enlarged plan of schools could be adopted, consistently with the ampler accommodations which would then be at our disposal. Foremost among the departments which would claim a portion of these accommodations, would be the new English school lately opened by the Board. Our predecessors have had frequent opportunities of expressing their sense of the importance of the mathematical school, established soon after the formation of the Institute, and their regret that it did not meet with that encouragement to which it seemed entitled. Believing that its failure proceeded from the circumstance that its plan was too restricted, and not sufficiently popular, the Board have this year established an evening English school; in which all the branches of a plain English education are taught; with this additional circumstance, however, that the high qualifications of the teacher will enable him to carry his pupils as deeply into the science of mathematics as it may be convenient or desirable that any of them should proceed. This school embraces, therefore, all that was expected of the mathematical school, while its more enlarged field of operations will, we hope, give it an additional degree of popularity with the members of our association. The salutary provisions of our laws, as well as the more powerful influence of public opinion, require that each apprentice shall receive from his master, during the term of his apprenticeship, a certain amount of schooling. Unfortunately, however, this part of the indentures is in many cases but imperfectly attended to. It is the object of the Board to establish a school of such a character as shall command the good opinion of our members, and induce that large portion of those who are engaged in mechanical pursuits to select it as the best for the education of their sons, and of the apprentices committed to their charge. To the journeyman, likewise, who wishes to improve himself, it will offer great inducements. Actuated by these views, the Board have selected for the teacher Mr. Seth Smith, and have placed the expenses of the school upon the lowest terms. The committee of instruction have reported to the Board

the entire satisfaction which they experienced from the judicious mode of instruction adopted by Mr. Smith, from the good order and attention which prevail in the school, and from the accommodations which it affords to those who now attend it. It has been open but a few weeks, and the number of pupils in attendance is consequently very limited, but there is reason to hope, that after it shall have been longer in operation, and have become more generally known, it will receive additional patronage, and by its increased numbers, as well as by its merits, reflect credit upon the Institute. To the fostering care and attention of their successors the Board would specially recommend this school, as an instrument calculated to produce great good.

The Board having ascertained in the beginning of the year, that a gentleman of this city was disposed to give a course of lectures on geology, provided sufficient encouragement were given him, granted to him the use of their room, free of rent, or expense of lighting and heating, on condition that corresponding advantages should be extended by him to such of our members as chose to attend the lectures, and it is believed that a number of them availed themselves of the opportunity.

The following schedule exhibits the benefits derived by the community from our system of lectures and schools; premising, however, that it does not include the number of members of the Institute that attend the lectures, but merely the extra tickets sold, during the last and the present winter.

	1830–1	1831–2
Lecture tickets sold for minors,	175	196
do. do. ladies,	42	63
do. do. strangers,	2	2
	219	261
Drawing school tickets, architectural department,	41	39
do. do. miscellaneous do.	19	suspended.
English evening school, recently established,		23
Aggregate,	279	323

Increase over last year 44.

The next subject to which we would invite your attention, is that of exhibitions. The experience of each succeeding year adds to our conviction that next to education, and second only to that in importance, are the displays of domestic manufactures made at stated periods under the patronage of the Institute. It would carry us too far at present, and indeed it would be a work of supererogation, to enlarge upon the great benefits which the country derives from them; it will suffice to state, that to the Institute itself they are of incalculable advantage—they keep it in close and intimate connexion with the manufacturers and mechanics not only of this city, but of the

Union at large—they quicken the zeal and interest of our fellow citizens in the prosperity of an institution, which, so long as it shall continue to restrict itself to its legitimate field of operation, cannot fail to receive, as it will deserve, extensive patronage—they gratify the just and honourable pride of the mechanic, and induce him properly to estimate the character of the association, which enables him without any expense or trouble to himself, to select in his obscure and remote workshop, the wares which, when exhibited in broad daylight before thousands of his fellow citizens, procure to him the meed of approbation, as well as the more solid benefits resulting from a due appreciation by the consumer of the merits of the manufactures of our own country. To promote these exhibitions, and to secure their success, it is the duty of those whom you have entrusted with the stewardship of your affairs, and who have accepted the trust, to spare no exertions, and to avoid no reasonable expense. Impressed with these views, this Board adopted at their very first meeting the project of holding an exhibition in 1831, and at their first stated meeting, they decided that as no views of mercenary profits influenced the Institute in their establishment, all the proceeds from the sale of tickets of admission, should go to the defraying of the expenses of the exhibition, and that any surplus funds should be appropriated to the improvement of subsequent ones. Accordingly the expenditures of the last exhibition have been upon a more liberal scale than those of any that preceded it. Our Actuary was sent to visit the principal manufacturing towns and establishments in the United States, in order to establish a personal connexion between the proprietors and the Institute. They were invited to send their goods to our exhibitions, the objects and character of which were fully explained to them. Several of them availed themselves of the opportunity of doing so, and others who were not prepared for the exhibition of 1831, have promised to contribute to them in future. The success of that held in October last has fully realized our most sanguine expectations, and is believed to have exceeded in interest any of those which had preceded. It has certainly shown that neither the zeal of our manufacturers, nor the interest of the public, had suffered the least impairment by the frequent repetition of our appeals to them. Influenced by these motives, the Board immediately afterwards considered the propriety of holding the eighth exhibition in October next, and resolved the question affirmatively. Without intending to decide that circumstances may not at some future time require that their recurrence be less frequent, we shall confine ourselves to the statement that hitherto no such necessity has presented itself, and that we are of opinion that it is the duty, as well as the interest of the Institute, however troublesome their exhibitions may be, not to shrink from them so long as they are productive of the benefits which have hitherto attended them. If any further proof be wanted of the estimate in which they are held by the public, we shall find it in the readiness with which the Institute have been intrusted with the appropriation of moneys raised for the advancement of certain branches of industry. The sum of one hundred and twenty

dollars was last year placed at their disposal to encourage a competition on stoves and grates for anthracite; of this fund one hundred dollars have already been awarded. A still more flattering proof of confidence was evidenced in the appropriation by the City Councils of the sum of one hundred dollars, to be awarded by the Institute to the successful competitor on street lamps, in October next.

With a view to do justice to all those who had deposited their wares at our last exhibition, a full account of it has been published in pamphlet form, and is in the course of distribution. To it is annexed the plan of the eighth exhibition, with the list of premiums to be then awarded; the Board would earnestly invite the members to assist in its extensive circulation. Finally, it is gratifying to the Board to state that they have succeeded in obtaining a sufficient number of medals to redeem the pledges given, not only at the last exhibition, but even at the preceding ones, and that a public distribution of them will take place on the 21st instant, and that it will be preceded by an address by a member of the Institute. Those to whom honorary mentions have been awarded, will at the same time receive the certificates which have been prepared for them.

The Journal of the Institute has been continued with every possible attention. The valuable services of our esteemed editor, Dr. Jones, have been secured for a continued period by a new arrangement equally satisfactory to himself and to the Institute, and the difficulties and obstacles produced by his distant residence have been removed by the assiduity of a committee of the Board. The Journal has, during the last year contained more original matter than at any former period. It includes the description of four hundred and seventy-two American patents, with remarks upon their respective merits, and full copies of the specifications, accompanied by plates, were published whenever the importance of the subject warranted it. The patronage which the Journal receives is gradually increasing, though by no means equal to what we would fain hope that it will be after its merits shall be better known and more fully appreciated. It is perhaps not sufficiently known that the Board have, by great exertions, succeeded in making arrangements which enable them to offer a liberal compensation to those authors who contribute communications to the Journal. This arrangement, it is believed, will add much to its merit. The nett increase in the list of subscribers during the last year does not exceed eighty-eight, but it is hoped that by due exertions a larger accession will be obtained.

The Journal has been enriched this year by the publication of meteorological observations; a subject which had been heretofore unattended to, but which in the present state of science should not be neglected. These are interesting, as it is believed that there are very few meteorological tables regularly published at this time in the United States.

The investigations, commenced two years since, on the subject of water power, were carried on with a perseverance and devotion on the part of the committee to which they were entrusted, that entitle the results which they have obtained to the fullest confidence. That

the range of their inquiries was extensive, and the attention bestowed upon each part, minute, will appear from that portion of their report which has been laid before the public. Those who had expressed surprise at the length of time which elapsed, before the commencement of the publication, have ceased to wonder at it, since the extent of their calculations has become manifest. The published part of the report already includes sixty pages, and contains the results of 694 experiments, the effect of each of which has been subjected to minute calculation. The residue will be published with as much rapidity as can be done, consistently with the numerous engagements of the gentlemen who are preparing the report.

The committee charged with the investigation of the causes of explosions in steam boilers, have also been zealous in the pursuit of the subject entrusted to them. An extensive diffusion of their circulars produced an accumulation of reports and communications, some of which contain much instructive and interesting matter. As the curious facts which it embraces seem to deserve immediate publication, a selection was made from the mass, and the publication has been continued for several months; adding, it is believed, to the interest of the Journal. In addition to this, the committee have made experiments upon many of the points which were deemed deserving of particular investigation, and have expended about one-half of the fund which was placed at their disposal for that purpose. It is hoped that the whole of the experiments will be completed in the course of a few months, when their results will be brought before the public.

The Institute have also commenced an investigation of much interest, into the resources of our great commonwealth, considered in relation to its industry and manufactures. It is one of the peculiarities of a country situated as ours is, that the constant increase of its wealth and population, as well as the great fluctuations produced by it, renders the task of collecting statistical information extremely difficult, while at the same time it becomes the more important. With a view to contribute their aid in this respect, and disavowing all considerations not strictly scientific, the Institute have raised a committee for the purpose of attending to this subject. The Board merely introduce a notice of it here, in order that their report may embrace a connected view of all the subjects which receive the attention of the Institute.

For the same reason, they would state that, it having been ascertained that a representation to the Secretary of State on the subject of the existing patent laws would be kindly received, a committee was raised in the Institute for the purpose of addressing a memorial to him on that subject, and that there is reason to hope that at an early day, the existing system, which is confessedly very defective, will be considerably improved.

The library of the Institute is receiving some additions; and the accessions by way of purchases, exchanges, and donations, are such as to give it increasing value. The reading room is daily becoming more attractive, and forms a useful point of union for our members.

The Board regret that the limited means of the Institute do not admit of giving to the library that extension which its importance deserves. The subject must be borne constantly in mind, in order that advantage may be taken of any favourable contingency.

The collection of models and minerals is in the same condition as at the last annual meeting. It is to be regretted that the finances of the Institute do not admit of any appropriation for their increase, but the Board recommend it to the zeal and liberality of their members to lose no opportunity of securing its extension.

Experience has proved the inconvenience attending the want of a collection of the objects that are used in the arts as raw materials, or that result from the various operations practised in laboratories and workshops. To the lecturer on chemistry, such a collection would be of immense advantage, and to the students it would be highly useful by bringing many objects before their eyes, and stimulating them to inquire into their nature and properties. Such a collection would not be expensive, but would require much time and assiduity to complete it. It is understood to be anxiously called for by our professor of chemistry, and the Board recommend it to the early attention of their successors in office.

There is a committee of the Institute, the duties of which are of the utmost importance, and which has, it is believed, been of some benefit to many respectable and ingenious mechanics: we allude to the committee charged with inquiring into all inventions submitted to them, and reporting upon their merits. Its duties are delicate and difficult, but they have hitherto been conducted in a manner to be useful to the applicants, avoiding all causes of offence to those whose inventions they are unable to commend. During the past year many applications have been made to them, most of which have been disposed of by reports.

This committee, as well as most of the standing committees, hold stated meetings once a month at least, and some even once a week. These frequent meetings, although consuming much time, are found to advance very much the interests of the various departments committed to them.

The Board have pleasure in informing the Institute that the diploma of membership, which it is understood has been anxiously wished for by many of the members, has been executed in a manner which they think will be creditable to the taste of the Institute, as well as to the state of the arts in our country. It will be ready for distribution among the members, as soon as a sufficient number of copies can be printed and prepared.

There is an object to which the attention of the Institute was called at the time of its origin, and which it has not yet had the means of carrying into execution. Its importance, and the calls for it, are, however, increasing from day to day. We advert to a chemical laboratory, devoted to practical operations, either in analytical or technical chemistry. There is at present no such establishment in the city; we believe there is none in the United States. In a place where the arts and manufactures are daily extending in importance

and value, the want of it is greatly felt. Our lecturers on chemistry have their time too much occupied by the preparation of experiments for their lectures, to be able to attend much to the practical instruction of pupils. The few professors, who are disposed to receive youths in their laboratories, make this, at most, but a secondary object; it is with them rather a matter of favour than of business. The advantages which France has derived from the able chemists that were instructed in the ancient laboratory of the Royal Mint, and in the more recent ones of Vauquelin, and of the Royal School of Mines, are too well known to require comment. The expense of fitting up such a laboratory would probably not exceed 1000 dollars, and would be amply repaid by the benefits which it would produce. There is not at present a place in which a person having a specimen of the most common iron or lead ore, can have it tested, or its value ascertained. A member of this Board, who at one time pursued this subject professionally, but who has relinquished it entirely, states that he has had more applications during the last year than he had during the four years that he kept a laboratory open in this city for that purpose. It is not improbable that if one were now established, and placed under the care of a skilful and competent individual, the expenses of it might be defrayed by a very reasonable charge for the instruction of pupils, and a small fee on all minerals and other matters brought for analysis or examination. To the community at large, the benefit would be very great, and to the Institute the establishment would be highly creditable. The Board recommend it to the early attention of their successors in office.

During the last year, the Board have elected 264 new members, and have received the resignation of twenty; making an accession to our members of 244, from which however some deduction must be made for deaths and removals not regularly reported to them. Among the deaths, the Board regret to number that of Mr. Joseph H. Schreiner, who for the last five years was one of their associates.

The report of the treasurer hereto annexed, exhibits an account of the receipts and expenditures during the past year, leaving a balance in his hands on the 10th inst. of $\$478\frac{77}{100}$, against which, however, must be placed the outstanding orders drawn by the Board amounting to $\$818\frac{85}{100}$, and leaving a deficiency of cash of $\$340\frac{08}{100}$ to be paid out of the future receipts of the treasury.

During the last year the following gentlemen have become life members.

Anthony Finley,	M. D. Lewis,
Thomas Scattergood,	J. J. Kates,
Robert Hoare,	Michael Kates,
Wm. B. Fling,	C. M. Eakin,
Rudolph Dietz,	W. J. Young.

The Board have not overlooked the necessity of continuing the salutary measures adopted by their predecessors for the reduction of the heavy debt incurred in the erection of their hall; and besides paying all dividends that were claimed to the amount of \$1515, they have added the sum of $\$1053\frac{58}{100}$ to the sinking fund, which now

amounts to $\$7398\frac{81}{100}$, reducing the debt to the stockholders to $\$26601\frac{19}{100}$.

All of which is respectfully submitted, by

(Signed,) M. D. Lewis, *Chairman.*

William Hamilton, *Actuary.*
Philadelphia, January 18th, 1832.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN AUGUST, 1831.

With Remarks and Exemplifications, by the Editor.

1. For *Uniting Cast Iron with Steel and Wrought Iron;* Asa Mallory, and Charles Miles, Concord, Geauga county, Ohio, August 1.

The proposed union is to be effected by bringing the piece of steel or wrought iron to a red heat, then placing it in a mould, applying to it brimstone, or borax, calcined with arsenic, with the addition of sal ammoniac, and pouring the cast iron on it. Or, the piece of steel and cast iron to be united are both to be brought to a red heat, and pressed together with some of the composition between them. Those who unite the metals in this way must use them gently, or the sulphuret of iron by which they are cemented, will assuredly give way. The process is neither new nor of any value.

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2. For an improvement in *Lamps;* Isaiah Jennings, city of New York, August 1.

(See specification.)

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3. For *Locks for Rifles,* called the "percussion side lock;" Elisha Strong, Clarindon, Geauga county, Ohio, August 2.

We have examined the description, drawing, and model, forwarded by the patentee, and with all these aids remain as ignorant of what he intended to patent as we should have been had we not seen either. The modle consists of something like a trigger, which is, probably, to be fixed upon the side of the stock.

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4. For *Applying Horse Power for Propelling Machinery;* Calvin Emmons, city of New York, August 2.

A wheel twenty or thirty feet in diameter, and placed horizontally, is to be turned by a horse. The wheel, so called, consists of a strong nave, or hub, with six or eight arms, ten or fifteen feet long, projecting from it. The hub has an axis passing vertically through it, which axis is fixed firmly in a piece of timber placed beneath it. There is no rim to the wheel, but the spokes are braced together by pieces passing from one to the other, at about one-third of their length from their outer ends. This allows of a space between the project-

ing ends of the spokes for the horse to walk in; the wheel standing no higher from the ground than is necessary for the draft of the animal, and the traces being attached to one of the spokes. The ends of the spokes are notched, to receive a band, they being intended to operate as a band wheel; this band extends out, and passes round a whirl, from which motion is to be communicated to any machinery which is to be propelled. The claim is to the construction and arrangement of the several parts of this apparatus. Its superior advantages we do not perceive.

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5. For machinery for *Jointing Staves;* Isaac Fobes, Bridgewater, Plymouth county, Massachusetts, August 3.

This jointing machine consists of a wheel turning horizontally, through the upper side, or face, of which project four, or any convenient number of irons, or cutters, passing in from below in the manner of plane irons. The face of this circular jointer is made concave from the outer towards the inner edge, the irons being adapted to this curvature; which is such that when the edge of a stave is placed upon it, the jointing shall leave it with the proper swell in the middle.

A rest is provided, against which to bear the stave whilst jointing.

The claim is to the principle upon which the machine operates, or, in other words, to the concave faced revolving jointer. Among the many jointing machines which we have seen and described, there certainly is not one which operates upon this principle. The only objection which we see to it is that the irons work against the grain for one half the length of the stave.

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6. For improvements in the *Mode of Kiln Drying Wheat Flour, and other kinds of Meal,* by the agency of heated air, or of steam, operating in an apparatus adapted to the purpose; Nathan Tyson, city of Baltimore, August 8.

We are waiting the result of some experiments now in progress by the patentee, which when completed will be published with the specification and an engraving of the apparatus.

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7. For a *Screen for separating Grain from the Straw,* called the horizontal revolving jointed screen; Peter Broughton, Charleston, South Carolina, August 5.

An endless apron is to be made of wove wire, which is divided into segments held together by leather straps; each segment is to be of such a width as to correspond with the flat sides of two hexagonal rollers, by which the endless apron is made to revolve. The straw and grain, as they leave the thrashing machine, are to be conducted in between the two sides of the revolving apron, at its upper end, which is a little elevated above the delivering end. The grain is to fall through the screen, and to be conducted to a winnowing machine, and the straw, when it arrives near to the second roller is to be thrown

off the screen by a sloping board placed for that purpose. There is no claim made.

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8. For an improvement in the common *Pump* for pumping water, Jesse Reed, Marshfield, Plymouth county, Massachusetts, August 5.

The chamber, and the whole of that part of this pump which is above ground, is to be of cast iron, and is to be attached to the descending shaft by a flanch with suitable bolts, allowing it to be removed with ease for the purpose of examination and repair. There is to be a thumb screw which, by being turned, will raise the valves, let off the water, and thus prevent freezing. There is but little of tangible novelty in the whole thing, and the patentee appears to be rather uncertain about his claims, as he makes them with this proviso, "unless the same have been used without the knowledge of your petitioner."

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9. For an improvement in the *Piano Forte Action;* Jesse Thompson, city of New York, August 6.

A lever, called an angle lever, is applied directly to the key and hammer, causing the blow to be struck the instant the key is moved. Judging by an inspection of the drawing, we should form a very favourable opinion of this action, which is much more simple and direct than those commonly constructed. The claim is to the angle lever alone.

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10. For an apparatus to *Filter Sirop, and wash the animal black, and other substances used for clarification;* Thomas Osenard, a citizen of the United States, now residing at Marseilles, in France, August 6.

This apparatus is intended principally for the use of sugar refiners and confectioners; it is complex, but is well represented on two lithographic drawings which accompany the specification. We shall not attempt a description of it, as without the plates it could not be made clear.

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11. For a *Washing Machine;* Nathan Hackett, Green, Clinton county, Ohio, August 6.

This machine, we are told, is to wash with or without steam. The box, or trough, to contain the clothes, has its lower part semicircular. A shaft suspended from the centre of the curve has two wings, or levers, upon it, which vibrate in the box; these wings are perforated with holes to allow the water to pass through. A stationary partition in the centre of the box, divides it into two parts; this partition also has perforations similar to those on the moveable wings. A vibratory motion being given to these wings by means of a crank on the shaft, the clothes are thus squeezed between them and the stationary partition. There is no claim made.

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12. For *Graduating Moulds for moulding and shaping*

Timbers for Boats and other vessels; James Wallace, Rochester, Monroe county, New York, August 9.

By the invention here patented it is intended to make one set of moulds answer the purpose of laying out timbers for vessels of all sizes. The moulds are to be divided, to have moveable joints and gauges, and to be kirfed in a way particularly explained and laid down in the drawing. The whole arrangement must be shown in order to give a correct idea of the inventor's plan.

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13. For a *Machine for hulling and cleaning Clover Seed;* Lemuel White, Adams county, Pennsylvania, August 9.

This clover machine is to be made pretty much like the ordinary cylinder thrashing machine, but it is to have two cylinders and two concaves adapted to them. The cylinders and concaves may be made of cast iron or of wood, and be covered with emery; or they may be covered with cards, so fixed that the teeth shall point with the motion of the cylinders, which is to be with their upper sides receding from each other. There must be a hopper for feeding, and a riddle and fan may be placed below, and moved with the machine.

The claims are to the use of two cylinders and concaves, the cylinders revolving as described; the mode of gearing; the plan of placing the cards, and of coating the cylinders and concaves with emery.

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14. For an improvement in the machinery for *Making Biscuits and Crackers;* John S. Stiles, city of Baltimore, August 9.

The dough is to be worked by a break, made very much in the manner of that now used, with angular slats striking upon it. The table upon which the dough is placed is to have a vibrating top, operated upon by a cam, that the breaks may not strike a second blow on the same place.

After being otherwise prepared the dough is to pass between two or more rollers, to reduce it to a proper thickness. It is then to be received between two other rollers, one of which is to have circular cutters, with proper dockers and letters, and the other may be covered with leather or any suitable substance. In each of the moulds there is placed a sliding piston, perforated for the dockers to pass through. This, by its weight, or by the action of a spring, causes the biscuit to fall out of the mould after it escapes from between the rollers.

The patentee acknowledges that all the parts described have been used before, "but not in the same connexion, or applied to the same purpose;" and claims the combination and application as described. On the 13th of June last, (vol. viii. p. 343,) Messrs. Fairlamb & Dunott, of Wilmington, Delaware, obtained a patent for a machine in which they apply some of the same parts "in the same connexion" "to the same purpose," and they expressly claim the moulding and docking by cylindrical pressure.

15. For an improved *Stock;* William Carlock, city of Baltimore, August 9.

This stock is to be cut in one entire piece out of hair cloth, with cotton or silk warp. After being cut it is to be stiffened with starch, or some similar substance. It is to receive its proper shape by being bent round a heated mould of the proper form, upon which it is to remain until dry. If the warp is of silk, it may be trimmed without first covering it; if of cotton, it may either be japanned or covered with any suitable material.

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16. For an improved *Standing Press;* John H. Stewart, county of Philadelphia, Pennsylvania, August 11.

This standing press is to have screws on each side instead of cheeks. Upon these screws are fitted nuts capable of turning, and which are to be attached to the platten, or follower, with a swivel joint. Upon each of these nuts, or screw boxes, there is to be a cog wheel, and between these a pinion gearing into each of them. The shaft of this pinion will be vertical, and on it may be placed a crown or bevel wheel, which may receive motion from a pinion upon a crank, the shaft of which runs in bearings upon the top of the follower. By turning this crank vertically, the nuts will be made to ascend and descend upon the screws, and any desired power may be obtained, according to the proportions observed in the gearing. Several variations of the principle are alluded to; this particular mode of constructing, or rather of gearing, the press, not being the object of the patent. We are told in the commencement of the specification, that "the improvement consists in constructing the press in such a manner as to dispense with the posts, or upright parts of the frame, and so that the power may be applied vertically." In the claim at the end of the specification, we are informed that the parts believed to be new, and constituting the invention, "are the construction of a standing press without the use of posts or upright timbers in the frame; the screw bolts so arranged as to operate as posts or supporters to the upper part of the press, at the same time that they perform the operation of screws. And also the application of power to a standing press in a rotary vertical manner, by the means of wheels and pinions, with handles, levers, cranks, or other fixtures for the application of the power."

At page 346 of the last volume there is a specification of a patent granted to Charles Evans, of Philadelphia, on the 13th of June last, which fulfils most of, if not all, the conditions of the above claim. Mr. Evans expressly claims "the application of screws instead of cheeks to the sides of the standing press." He also turns his gearing by means of a handle or crank "in a rotary vertical manner." The only noticeable difference is that Mr. Evans uses an endless screw in preference to a pinion, but the question of identity can scarcely rest upon the difference here noticed.

17. For applying *Zinc, or Spelter, to the making articles of various kinds*; Samuel Davis, city of New York, August 11.

The patentee tells us that he has made the discovery that weights of from one ounce to fifty-six pounds, may be made out of zinc; and also that book binders' plates, chaffing dishes, portable scrapers, baking plates and griddles, may be formed out of the same substance, and therefore prays that he alone may have the right to make the articles thus specified.

There is something really curious in the progressive discoveries of the patentee of the above articles of zinc. By a patent dated October 1, 1830, (vol. vii. p. 368,) it appears that he had then discovered that milk pans might be made out of zinc. Another, dated April 18, 1831, (vol. viii. p. 124,) tells us that he had in addition discovered that many articles of hollow ware for cooking, as well as others for use and ornament, might be so made; and it will be seen above, that he has made further discoveries of a similar character, and one of the number is, that weights as low as an ounce, and as high as fifty-six pounds, may be made of zinc. If these are patentable discoveries, the iron founder may patent every article which he casts in a new form, and close the furnaces of all competitors.

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18. For *Shears for cutting Paste Board, Sheet Iron, &c.*; Alvah Hardy, city of Boston, Massachusetts, August 12.

The inventor calls these shears "curved edge shears." He makes them in the usual manner of those shears which have the fulcrum at the end, and he curves one or both edges, in such a degree as to cause them in cutting to meet at nearly the same angle throughout their whole length. When the curvature is given to one edge only, it is to the upper one. A weighty knob is to be formed on the end of the handle to assist, by its gravity, in cutting.

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19. For a machine for *Hulling and Cleaning Clover Seed*; William Williams, Buckingham, Bucks county, Pennsylvania, August 12.

There is a feeding apron upon which the clover is laid, and by which it is carried towards the body of the machine; the clover falls from off this apron into a vertical opening, situated between a revolving fan wheel and the hopper. Stones, sand, and other heavy articles descend entirely through this opening, as do seeds which are heavier than the clover, whilst the latter is driven by the air from the fan up an inclined plane into a hopper. Below the hopper there is a revolving cylinder, covered with sheet iron, and set with fine teeth; this revolves within a hollow segment which embraces nearly three-fourths of its circumference. This segment is also set with teeth, excepting the last portion of it which is punched so as to form a grater. The cylinder and segment are adjustible by wedges.

The claim is to the peculiar arrangement of the parts as described.

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20. For a *Machine for Gumming and Trimming Saws*;

Joseph Spencer, Canajoharie, Montgomery county, New York, August 15.

If those persons who have taken patents for machines for gumming or cutting the teeth of saws, had visited the manufactories where these instruments are made, they would have discovered that the manufacturers know as well as any body, how to cut saw teeth; and that the machines which have been patented are mere variations, or modifications, of such as are well known. The one before us is in fact a bed and punch, with a gauge for regulating the distances of the teeth, acting upon principles, and in a manner, long in use.

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21. For a machine to give an *Alarm when a Building takes Fire;* Ithiel S. Richardson, New Market, Rockingham county, New Hampshire, August 15.

An alarm bell is to be attached to suitable wheel work, which, when acted upon by a weight suspended from a barrel, will cause a hammer to vibrate within the bell, and sound the alarm. From this apparatus, a string extends to the different apartments of the house, being conducted round angles by means of pulleys; this string is attached to, and supports a weighted lever, which checks the barrel of the wheel work, but if the string be burnt off in any part, this weighted lever will be liberated, and the alarm sounded.

A particular manner of combining and arranging the apparatus is described, and represented in the drawing, and the claim is to the mode of arrangement described. Any one, who is well acquainted with machinery, could devise modes very different from that given by the patentee. He, however, was probably aware of the fact, that the same principle, the burning off of a string, had been applied to the sounding of an alarm in case of fire, and thought it best, therefore, to confine himself to his own particular plan.

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22. For a machine for *Edging Metallic Plates for Roofing;* Daniel A. Piper, Cincinnati, Hamilton county, Ohio, August 15.

Two stout pieces of plank are to be hinged together like double shutters; upon the hinged edge of one of them, a rebate is to be formed, which may be covered with iron, and upon the edge of the other piece of timber an iron plate is secured by screws. The tin to be edged is slipped into the rebate, when the timbers are folded together, and the edging effected. This, the patentee tells us, is a much better mode than the old one, which required the use of a hammer; we can assure him, however, that it is a much worse mode than that supplied by other machines which have been invented for the purpose, and which do not require or admit the use of a hammer. Such machines, it seems, have not yet travelled to Cincinnati, although they are well known in the northern states.

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23. For an improvement in *Brick Moulding;* David Fox, Ashtabula, Ashtabula county, Ohio, August 15.

This machinery is too complex to be described in words, excepting in a very general way. There is a hopper into which the prepared clay is to be put; under this hopper the moulds are made to pass in succession by the action of a lever, the empty moulds pushing the full ones forward, whilst another lever gives motion to a follower and other apparatus which forces the clay from the hopper into the mould, and also operates upon a scraper which removes what is superfluous.

The claims are to the strike and press as constructed in this machine, and also to the scraper, the forcer, the peculiar angles of the two levers, and some other parts which it is unnecessary to mention.

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24. For *Machinery to be applied to Grist Mills, Saw Mills, &c. &c.* called the 'roller and balance wheel power;' Joel Ester, Brownsville, Haywood county, Tennessee, August 15.

This machinery is to be the guide, governor, and director, of machinery in general, as it is to be a first mover to drive mills of all kinds, and to propel boats. It is proposed, in most cases, to use the power of a horse to communicate the first motion, as in the common horse mill. From the large horizontal wheel which the horse turns, wallowers, counter wheels, large and small balance wheels, an inclined wooden wheel twenty or thirty feet in diameter, and, at the end of this train, a mill of any description, are all to be set in operation. It appears altogether uncertain whether the horse, or any extraneous motive power, will be really required, as, under ordinary circumstances, "one horse gives the power of ten or fifteen." But if the machinery be increased in size, "the large balance wheel being thirty feet, or from that to forty, in diameter, with a heavy rim, and its balance wheels well proportioned, it is believed it will move and turn in *perpetuam* without the aid of a horse."

When an individual is so far gone as to imagine that a machine will move the more readily the more you load it, it is of no use to reason with him, least he turn again and rend you: the only wise course, is to allow him to make his machine, and to load it until either he or his contrivance, is broken.

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25. For an improvement in the *Horse Rake;* William Phillips, Middlesex county, New Jersey, August 15.

The principal improvement in this rake consists in applying four small wheels to it, two at each of its ends. These wheels are of such a size as to keep the teeth of the rake at the proper distance from the ground, whilst they are to take off the friction usually experienced in similar instruments, and to render the draft perfectly easy. By the aid of the handles which serve to guide it, and of others upon which a boy is to operate, the rake is to be relieved of its accumulated load, without checking the motion of the horse.

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26. For an improvement in the *Manufacture of Sugar;* William Augustus Archbald, Sugar Refiner, city of New York, August 16.

The improvement here proposed consists in converting the sirop, or cane juice, into loaf sugar, without first granulating it, and forming it into raw, or other, sugar. The juice, it is said, should be prepared in the way specified in the patent granted to Mr. Archbald in the month of April, 1830; after which it may be boiled down to twenty-six or to twenty-eight degrees of Beaumé's sachorometer, if intended for immediate use; but if for keeping, or transportation, to from thirty-six to forty degrees. When of the lower density, for immediate use, it is to be examined by test papers to detect any acidity, which is to be corrected by milk of lime, prepared in the ordinary way, and added in small quantities until the acid is neutralized.

When perfectly neutralized it is to be put into a boiler, and heat applied until the sirop boils, the heat from steam being preferred. Three pounds of fineings are to be put in in addition to the portion originally employed, as directed in the patent referred to; this three pounds of fineings is the proportion for every thirty gallons of sirop. After boiling for two or three minutes it is to be filtered through animal charcoal; or, instead of filtering, from five to ten pounds of animal charcoal are mixed with the sirop, the boiling stopped, and a quart of bullock's blood thrown in to the above named quantity. When intimately mixed the sirop is to be again heated until the scum rises. Should it not prove perfectly clear, more blood is to be added in the same way. The whole is to be allowed to settle, and is afterwards strained through a filter, Howard's being preferred.

Sirop prepared in the ordinary way, it is said, may also be boiled down and treated according to the same principles, for the purpose of converting it at once into lump, or loaf, sugar.

The advantages of the process are said to be a considerable increase of *fine* sugar from a given quantity of juice, and the saving of much time, labour, and expense.

The claim is to the process by which loaf or lump sugar is made from the cane juice, without first converting it into raw or dry sugar.

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27. For an improvement in *Trusses for the cure of Reducible Inguinal Hernia;* Amos G. Hull, city of New York, August 17.

A patent was first obtained for this truss on the 17th of July, 1817, and last on the 20th December, 1830. Between these dates the patentee surrendered his patent three times, namely, on the 27th of February, 1823, on the 19th August, 1824, and on the 20th October, 1829. The patentee states, however, that his instrument was brought to its present improved state on the 27th February, 1823, and in the petition for his present patent requested that it might be issued to bear date from that time. This, we understand, has been done, and the improvements which he has made incorporated in the amended specification. Notwithstanding the high authority by which, as we are informed, this procedure has been sanctioned, we are fully of opinion that his present patent will be invalidated if examined in court. The patent of February, 1823, dated from July, 1817, hav-

ing been issued upon a surrender of the first patent, was therefore the same instrument amended, and, of course, it expired on the 17th of July last. By reissuing it, as though the original had borne the date of 27th of February, 1823, the patent is obtained for nearly twenty, instead of fourteen years, the legal term.

Independently of the last consideration, the fact that the patentee has not merely corrected what was error in his former specifications, but has introduced improvements not originally contemplated by him, makes the present, essentially, a new specification. This new matter might, legitimately, have been the subject of a patent for an improvement, but cannot, certainly, be employed to lengthen out claims to that which, by the terms of the patent law, has become public property.

It is probable that before the present number of this journal is printed, we shall have something further to say upon the subject of reissued patents, as we expect the decision of the Supreme Court respecting it.

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28. For an improvement in the mode of *Fastening the Soles and Heels upon a Boot or Shoe*, with wooden or metal pegs, and of paring the same; Wales Tileston, Charlemont, Franklin county, Massachusetts, August 18.

A block is to be prepared of the size of the sole of the boot or shoe, and of such curvature as to fit on to the sole when placed upon the last. This block is to be of a thickness corresponding with the length of the pegs to be driven, and is to be perforated near its edges with as many holes as there are to be pegs. From the back, or upper side of this block, two pins, or tenons, rise, upon which other plates, or blocks, provided with corresponding mortises, may be passed down into contact with the first. A second block, or plate, of the same size with the first, is placed upon it, being guided by the mortises and tenons. This block is perforated with holes corresponding with the first, and has projections from its edges by which it may be fixed to, and hold the work fast in, a frame.

A third block is prepared, with mortises to slip over the pins, or tenons, and with as many awls fixed in it as there are holes in the other blocks; they must be of sufficient length to pass through the two former blocks and to perforate the soles; to effect which any adequate power may be applied. When this block, containing the awls, is removed, pegs are dropped into the holes, and a block filled with blunt pointed wires, instead of the awls, is then applied and made to press upon the pegs, and drive them into the sole. This last block may be surrounded by a knife, or cutter, which, whilst the pegs are forced down, will pare the sole. A similar apparatus is to be used for the heels.

There is no claim made.

A patent was granted to Nathan Leonard of Merrimack, New Hampshire, June 11th, 1829, for a mode of pegging essentially the same with the foregoing. An account of the invention will be found

at p. 180, vol. iv. The first perforated plate, a plate with awls, and one with blunt wires, are all particularly described in that patent.

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29. For a *Wheat Rubber, for cleaning Grain;* David Marracong, Skaneateles, Onondago county, New York, August 18.

Sheets of iron, perforated with holes so as to form rubbers, like graters, are to be nailed upon wooden planks, and the upper one is to receive a vibratory motion by means of a crank and pitman. Cleets are to be placed along the edges of the rubbing boards, to keep and guide them in their places. The grain is to be let on by a suitable spout.

There is no claim made, and the apparatus is so similar to what has been before used, as scarcely to leave room for any.

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30. For a machine for *Sawing Shingles*, Clap Boards, &c. Jonathan Hobbs, jr. Falmouth, Cumberland county, Maine, August 18.

We shall not attempt to give any idea of this machine further than to say that a circular saw is used in it, and that there is an apparent complication of parts about it, which would require more time and attention for its examination than we can at present devote to it. The specification itself is five yards long, and closely written, and refers throughout to numbers upon the drawing. Without this, therefore, the ideas of the patentee could not be made known; and as these do not appear to extend to any thing new in principle, but to be confined to the special arrangement of the respective parts, we pass them without further notice.

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31. For a *Washing Machine;* John Shull, New Petersburg, Highland county, Ohio, August 19.

This is a steam washing machine, and not very different from several others already patented. The body of the machine is in the form of a barrel churn, and is placed on trussels. There is a cover fitting closely at the top of this barrel; within it a shaft revolves, carrying an interior cylinder, perforated with holes, and operating like the dashers of a churn. The clothes are to be put within this inner cylinder through openings prepared for the purpose. There is a boiler with a safety valve, and a steam tube leading through the end of the outer vessel. The operation need not be further described.

The claim is to the formation of the inner revolving cylinder, and the admission of steam in the manner described.

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32. For a *Washing Machine;* Webber Furbush, Hallowell, Kennebeck county, Maine, August 19.

This is a true old fashioned washing machine, consisting of a trough the bottom of which is curved, and over which rollers, set in a proper frame, are made to vibrate, and pass over the clothes placed upon the bottom. This bottom the patentee calls a smooth apron, and he very boldly claims nearly every part of the machine. He says, "I

claim the use of the rollers in the side pieces—I claim the use of the smooth apron—I claim the mode of applying these to use in a box or tub."

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33. For an improvement in the art of *Distillation;* John Cairou, city of Boston, Massachusetts. Patent first issued January 10, 1831; surrendered on account of a defective specification, and reissued August 22.

We remarked upon the original specification of this patent at p. 304, vol. vii. to which article we refer; the reference to a model throughout the specification, was particularly noticed, and it is now said that "the errors which render the existing patent defective, are a reference to a model of Mr. Cairou's machine for explanation of various parts of it, which are not sufficiently described in consequence of his supposing such a reference, (viz. to a model,) would supply the deficiencies of description—and other errors of similar character."

Mr. Cairou observes that although he is the original inventor of the column described in his specification, he does not now claim letters patent for the same, as detached and separate from the other parts of the apparatus; but what he claims is the combination of the several parts, to produce the effect described.

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34. For an improvement in the *Turnabouts for Rail-roads;* James Stimpson, city of Baltimore, Maryland, August 23.

The *turnabouts* for rail-roads are circular platforms large enough to receive a rail-road car, and placed level with the track. By their means a car can be turned entirely round, or into a road crossing that upon which it originally stood.

Turnabouts have been patented in this country; (see vol. vi. p. 291.) When Mr. Fairlamb's patent was issued, we were not aware that such turnabouts had been already introduced in England, but this being the fact, the patent here was not valid, although the patentee might have been a real, though a second, inventor. The present patent is taken for improvements upon the mode of forming them; some idea of the nature of which improvements may be derived from the claim, which is as follows:

"What I claim as my invention or improvement, is the application of cast iron for the platform of the turnabout, in form aforesaid, or any other manner. Also the construction of turnabouts as above set forth. Also the double tracks on turnabouts at right angles with each other, as herein set forth. Also the cheek bolts for fastening turnabouts in their proper positions by its own movement, caused either by gravity, or otherwise, for any kind of turnabouts. Also the stone or brick curbing surrounded with iron plates, as above set forth, or otherwise. Also the connecting the track rails with those under them, and the transverse timbers for security against frost, &c., as used as the foundation of turnabouts, as above set forth, or otherwise."

We think the above claim rather too comprehensive and sweeping throughout; we doubt the validity of a claim, for example, to the application of cast iron for the platform, in form aforesaid, *or in any other manner*, &c. &c.

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35. For an improvement in the construction of *Wheels for Rail-road Carriages;* James Stimpson, city of Baltimore, Maryland, August 23.

It is observed in the specification that the side of a wheel to which the flanch is attached, is much the strongest, whilst the opposite side is the most subjected to those accidents which tend to break the wheel; the improvement proposed is to strengthen this side of the rim by a ring of additional metal in the casting; and the patentee says he has no doubt that fifteen pounds of metal, forming such a ring will give more additional strength to the wheel, so as more effectually to protect it from breaking, than one hundred pounds equally distributed throughout the whole of the rim.

The claim is to "the application of the rim, ring, or felloes, inside of the tread, or rim, or inner periphery of the wheels, opposite to the flanch."

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36. For an improvement in the mode of *Ascending and Descending Rivers, and Canals, or Inclined Planes,* using such steam engines, or other locomotive power on board, or within the vessel, or vehicles to be moved, as may be found necessary for their ascent or descent; James Stimpson, city of Baltimore, Maryland, August 23.

Firm fixtures are to be made at the upper and lower ends of the planes which are to be ascended or descended, and chains, which may be of the kind used for cables, are to extend from one to the other of them, being supported on the ground, or on fixtures placed for that purpose. A shaft is to extend across the ways of the inclined plane, and when there is a chain on each side of the ways, there are to be cast iron pulleys on each end of the shaft; which pulleys are to be so cast that the links of the chain may fit precisely into them, there being hollows in the middle of them, and indentations in their cheeks, or flanches, for that purpose, which will prevent the chain, as it lies upon them, from slipping. There may be three, or more pulleys, of different sizes, to be used in different ascents. By means of cog wheels, with which the vessel, or carriage, is to be provided, power is to be derived from the steam engine, or animals, &c. within the vessel, to act upon the shaft carrying the pulleys, and thus to make the desired ascent.

The specification, which goes much into detail, includes a great variety of propositions, but the following are the claims made. "The application of chains to ascend and descend upon rivers and canals, or inclined planes on rail-roads, or otherwise, said chains being made fast at both ends near the foot and top of the inclines, and resting upon the ground or other material, or at suitable places in rivers or

canals, the locomotive, or other engines, drawing themselves up, or letting themselves down said inclines, rivers, or canals, by the power which is on board of themselves by the agency of pulleys in contact with said chains, as set forth in this specification, *or in any other way;* also the variable speeds or powers as herein set forth, *or in any other way.* For locomotive carriages on rail roads, not using the chain, I also claim the application of machinery to change the moving power from the road wheels of locomotives upon rail-roads where the inclination is too much for the adhesion of the wheels to the rail plates to allow them to ascend or descend without slipping or sliding upon said rails, to a pulley shaft as aforesaid, or any other thing whereby said purpose is used in a different manner than in immediate contact with the road wheels, or their axles, as set forth in this specification."

We might here repeat a portion of the remarks made on the last specification, as we think the present claim much too broad. The plan itself, however, appears to us to be altogether impracticable in the form presented, and its details exhibit a want of knowledge in the most advantageous modes of applying power.

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37. For an improvement in the *Mode of turning short curves on Rail-roads,* such as the corners of streets; James Stimpson, city of Baltimore, August 23.

The plan proposed is to make the extreme edges of the flanches flat, and of greater width than ordinary, and to construct the rails in such a manner that where a short turn is to be made, the extreme edge of the flanch shall rest upon it, instead of upon the tread of the wheel; thus increasing the effective diameter of the wheel in a degree equal to twice the projection of the flanch. The claim made is to "the application of the flanches of rail-road carriage wheels, to turn short curvatures upon rail-roads, or tracks, particularly turning the corners of streets, wharves, crossing of tracks, or roads, and passing over turnabouts, &c.

On turning to pages 270 and 271, vol. iv. there will be found specifications of two patents granted to James Wright, of Columbia, Pennsylvania, for the mode of turning curves claimed by Mr. Stimpson. The only difference is, that Mr. Wright proposes to adopt his cars to several different curves, by having three, or more, offsets in his wheels, when necessary.

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38. For an improved mode of *Opening and Shutting Switches on Rail-roads;* James Stimpson, city of Baltimore, Maryland, August 23.

Those who know any thing of rail-roads are aware that what are called switches, are pieces of iron employed at turn out places, which pieces, or bars of iron, have to be opened and closed, according to the track upon which the carriage is to travel; and that accidents have frequently occurred in consequence of the switches not being opened or closed as required. The plan proposed in the specification of the above patent, is to arrange certain levers, and other machinery, so

that a piece projecting from the carriage shall operate upon the switch and give to it its proper direction, either by day or night, without personal attention on the part of the person having the care of the carriage. The claim is to "the application of machinery to open and shut switches, whereby the drivers of carriages, or superintendents of locomotive engines, or others, without stopping, or leaving their seats, carriages, or horses, can open and shut switches, *if in order*, by night, or by day, without seeing them, by machinery, as set forth in the above specification, *or in any other way or manner.*"

The contrivances proposed, "if in order," might answer the purpose, but from their complexity, we apprehend that they would prove to be traps rather than protectors.

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39. For an improvement in the mode of *Forming and using cast or wrought iron plates, or rails, for Rail-road Carriage Wheels to run upon;* James Stimpson, city of Baltimore, Maryland, August 23.

The claim in this case is to "the application of cast or wrought iron plates for the use of rail-ways on the streets and wharves of cities, or elsewhere. The objects of said improvement being to employ rails that will not present any obstacles to the ordinary use of streets, or sustain injury therefrom, and so to form the plates at the intersections of streets, or other crossings, that cars will readily pass over them, and also on circles of small radius."

The rails are to be formed with a groove in them to receive the flanches of the wheels; on one side of the groove, the width is to be sufficient for the tread of the wheel; on the other, it need not exceed three-quarters of an inch. These rails are to be laid flush with the pavement of the streets. At corners to be turned the rails are to be cast, or made of the proper curvature, one of them only being provided with a groove, as the flanch is to run upon the other, upon the principle described in No. 37. Provision is to be made by scrapers, or brushes, preceding the carriages, to clear the grooves of dust, ice, and other obstructions.

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40. For an improvement upon *Dearborn's Patent Balance;* Uel West, and Daniel Loring, city of New York, August 23.

The alteration or improvement here patented, consists in so making the beam of the steelyard, or balance, as that the hook upon which the scale, or article to be weighed, is hung, shall be much nearer to the fulcrum than it has hitherto been placed in Dearborn's balance. For this purpose, it is sustained upon a pin between two cheeks, almost directly under the fulcrum. The object to be accomplished is to weigh a given weight with a beam much smaller than usual. The patentees state that a beam then before them, will weigh twenty times as much as any other of the same size.

There can be no doubt that the end proposed can be obtained by the prescribed means; but one other thing is equally certain, namely,

that the accuracy of the instrument will be sacrificed in a degree exactly proportioned to the extent to which this improvement is carried.

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41. For an improvement in the *Machine for weighing Canal Boats, Loaded Wagons, &c.;* Daniel Loring, Newark, New Jersey, August 23.

The general principles of this machine are well known to engineers. The claim made is to the form and general arrangement of the combination of levers of which it is principally composed; and the steel edge bearings, the bearings heretofore used being points, which soon wear out, and require to be repaired or renewed, whilst edges, well made, will work equally well, and are much more durable.

The use of edges for the fulcra of such weighing machines, is not new. Those patent weighing machines made by Mr. Ellicot, of Philadelphia, have steel edges.

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42. For an improved portable *Smut Machine;* Henry Weed, and Stephen Fellows, Sandwich, Strafford county, New Hampshire, August 23.

This smut machine is much like some others, and the improvements claimed to have been made by the patentees do not essentially alter it.

A box or chest is to be made to contain the machine. A cylinder, about twelve inches in diameter, and four in height, is made to revolve vertically, by a strap passing round a whirl on its shaft. This cylinder may be left smooth, or it may be covered with sheet iron cut into strips, or brads made rough, or nails in clusters, may be driven into it. A sheet iron cylinder, punched from the outside, so as to form a grater within, is to surround, and stand at a suitable distance from the revolving cylinder; between these, of course, the grain is to pass, the feed being from a hopper, the grain falling from it on a seive, and from that on to a second seive, kept in motion by a crank. A fan also is kept in motion, to blow away the chaff and dust.

What is claimed as new, is "the placing the machine in a chest. The shape of the brads. The making them rough. The manner of placing them in the cylinder. The driving of the nails in clusters. The cutting sheet iron into strips, and making them rough like rasps."

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43. For a *Saw Trimmer;* Adam Clark, jr., Berne, Albany county, New York, August 24.

This saw trimmer, or instrument for gumming saws, as it is usually called, purports to be an improvement on a similar instrument patented by John R. Fairling and Robert G. Nellis, April 27, 1831. We are told that instead of making it in detached pieces, and fastening them together by a screw and nut, as they did, the present instrument, though similar in form to theirs, is made somewhat larger, and in one entire piece of cast iron. The claim is made to the foregoing improvement.

In our estimation, neither of the patents is of any value, because we do not think them new. The specification of this last patent places in a strong point of view, the trifling change upon which many persons imagine a patent may be founded. The drawing of this instrument, and of that noticed at No. 20, are strikingly similar.

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44. For a machine for *Cutting Laths from Boards;* Jacob Jameson, Springfield, Clarke county, Ohio, August 24.

This machine consists, principally, of two rollers, between which the board to be cut into laths is made to pass. The lower roller is smooth, and merely sustains the board. The upper roller is furnished with circular knives of about four inches in diameter, passed on to an iron shaft, with collets between them to regulate their distances. There are two cranks, one at each end of the roller containing the knives, and the turning of these cranks draws the board through, which is delivered in the form of laths. The frame for sustaining the rollers, and guiding the board, we need not describe. We presume that the boards are to be first sawed to the *thickness* of the laths, and that they are only cut to a *width* by the knives, and the drawing also seems to indicate this. Such knives would not cut through an inch board of the softest wood, so as to form it into laths.

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45. For a *Plough;* William Savage, and Hezekiah Davidson, Barren county, Kentucky, August 24.

The plough looks pretty much like other ploughs, and we apprehend that all the improvements of which this instrument is susceptible, is in its details. In the present instance, the claim to improvement consists in "the wing and bar being in separate pieces, and confined by a nib and socket together, with a horizontal screw entering through the wing, mould board, and upright," "so that by taking out said screw, the wing can be taken off and sharpened, or laid, as easily as a common weeding hoe, leaving the bar always fast to the stock; the regulator, also, to make the plough cut deeper or shallower; all these things we claim."

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46. For a method of *Propelling Boats,* and various kind of machinery, called the "self-supporting chains;" Billy Todd, Marietta, Washington county, Ohio, August 24.

When Redheffer's perpetual motion refused to go, a gentleman who had formerly been numbered among its advocates, when reminded of his former opinion, observed that he should insist upon it that it was "perpetual motion, still." The present patentee may derive a lesson from this anecdote, when his propellers refuse to do their duty.

Two endless chains are to be made of cast iron; the links are to be in the shape of key stones, and are to be hinged together at their narrower ends, so that they will form an arch when their wide ends are uppermost; each of the links may measure about six inches each way. The two endless chains thus formed, are to be passed over a shaft, at the distance of a few feet from each other. Planks are to extend from

one chain to the other, mortises being cast in the links for the purpose of receiving them, so that each pair of links has its plank, the whole forming a continued floor.

For a two horse power, the links are to be of the size above mentioned, and will weigh about twelve pounds each, and, according to the drawing, from fifty to sixty of these will form one of the chains. These, with the floor, and the cattle, *or water*, by which it is to be operated upon, will form a load which has to be sustained by the cast iron links, and the wrought iron pins which form the joints, or hinges; and should these pins, or the cast iron, give way, wo to the animals employed.

The inventor says that he expects and claims the right to use this apparatus for propelling boats, and all other kinds of machinery, either by animals walking upon the floor, or by placing upon it buckets like those of an overshot wheel, and moving it by water. He also claims the right of placing one shaft higher than the other. He also claims the right of varying the size of the chains, and of making them of other materials than cast iron.

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47. For an improvement in the mode of *Making Beds*, called the spring bed; Josiah French, Ware, Hampshire county, Massachusetts, August 25.

A foundation is to be made by uniting boards together, the length and width of the intended bed. Wire, of about an eighth of an inch in diameter, is to be bent round a cylinder of four inches in diameter, so as to form it into spiral springs of about eighteen inches in length. A frame of the dimensions of the bottom is to be provided, and the springs are to be attached to the bottom, and by their upper ends to this frame. The two are to be drawn together until they are about nine inches apart. On the top of the springs a covering of cotton batten is to be placed, and a covering of duck is to be strained over the frame, covering the cotton batten and the springs. This will also be carried over the sides, and be nailed to the board bottom. Cotton batten, or other soft substance, is to be laid upon the duck, to form the filling of the bed; and when ticking is strained over this, and is nailed to the bottom, the bed is completed.

Until experience convinces us that we err in judgment, we shall rest satisfied with, and, we hope, comfortably on, a good curled hair mattrass, or in winter, if pleasure is preferred to health, a well filled feather bed will continue to satisfy us, and be preferred to iron springs.

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48. For a *Kiln for Burning Lime*, with anthracite coal; Joseph M. Downing, Bristol, Bucks county, Pennsylvania, August 25.

This kiln is for the burning of lime by means of anthracite, and the patentee, who has had it in actual operation, states that the lime produced by it is free from coar, and equal for all purposes to the best lime burnt with wood. The kiln is built of stone, with lime mortar, and is lined with fine brick, soap stone, or some similar substance.

The general form of the interior is that of an egg standing vertically, with its top truncated, so as to leave an opening for feeding.

There are no grates, or bars, at the bottom, the lime being allowed to settle down, and is to be withdrawn through an opening left for that purpose.

The stone to be burnt is broken into pieces, the largest of which shall not exceed six inches in diameter. In charging, the larger stones occupy the middle of the kiln. About one-fifth as much coal, broken fine, as there is of stone, is intimately mixed therewith, when both are of the ordinary quality, with this, however, the quantities must be varied.

The claim is to the so constructing the kiln as to dispense with the arch, bars, or grates, to sustain the lime and fuel; and to the general form of the structure.

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49. For an *Instrument to Plumb and Level;* Joseph C. Eldred, Rochester, Monroe county, New York, August 25.

This instrument consists of a rectangular piece of wood, or other substance, which may be two or more feet in length. It may be four inches broad and an inch and a quarter thick. A mortise is to be made through the middle of this piece, the sides of which mortise should be bevelled, to show the spirit levels to be placed within it, of which there are to be two, one at the side, and one at the end. This constitutes the whole instrument, and the patentee very truly informs us that it is "somewhat *similar* to the common spirit level."

The claim is to the instrument as described.

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50. For an improvement in *Bedsteads;* William Gamble, city of Baltimore, August 25.

Instead of a mortise in the posts, where the rail is to enter, a socket containing a female screw is to be firmly inserted. A screw on each end of the rails, fits into the sockets. The rails are round, and the screws upon their ends have shoulders of the same diameter with the rails. These screws turn upon a pin or mandril, which passes through them, and is secured to the rail; the screws can consequently be turned, and screwed into their sockets without turning the rail. The sacking bottom is attached to each of the rails, in a way described, and by turning the rails it may be tightened in any degree. A bolt passing into a hole in the shoulder of the screw, holds it in its place. Instead of the screw, a piece may be fitted into a socket which shall tighten by a slight turn, in a way very similar to some bedstead fastenings now in use.

The claim is to the foregoing arrangement.

The only objection which we see to this improvement, is its expense. The swivelling screw and its appendages, must very considerably enhance the cost of a bedstead, and prevent it from coming into general use. If well made, the apparatus would undoubtedly operate satisfactorily.

51. For improvements in the *Manufacture of Sugars;* Lemuel Wellman Wright, a citizen of the United States, now residing in the city of London, in England, August 25.

There are three objects intended to be accomplished by the arrangements now patented. The first, is an improvement in the evaporating apparatus. The second, the application of a peculiar solvent for the purpose of removing the molasses from the granulated sugar, without injuring the sugar; and the subsequent recovering of a part of this solvent. Thirdly, an apparatus for drying the sugar, and recovering the remainder of the solvent.

In the apparatus for evaporating, four, or more, pans may be used, one only of which need be of the improved construction. This pan, which may be of copper, is to be double, and the space between the two pans is to be two-thirds filled with a strong solution of chloride of calcium, [oxymuriate of lime.] Such a solution may boil at a temperature of about 250 or 260 degrees of Fahrenheit, and will therefore apply a safe and efficient heat to the pan containing the sugar. There is a safety apparatus described and figured, to prevent accidents from the boiling, and a supply apparatus to admit water to keep the solution of chloride at its proper strength. There is also a blowing apparatus, which forces heated air through openings in tubes near the bottom of the boiler, and these, as the contents become concentrated, cause it to be agitated, and to part readily with its remaining water.

The solvent to be used is alcohol, to every gallon of which about half an ounce of strong muriatic acid may be added; this being preferred to the other acids. After the granulated sugar has parted with the larger portion of its molasses by drainage, about a gallon of this solvent is to be inspersed upon every two or three hundred weight of sugar, which will dissolve, and cause a rapid discharge of the impurities. After this, simple alcohol, in the proportion of two or three gallons to a ton, is to be poured on, which will run freely through the sugar, carrying with it the remainder of the impurities. A large proportion of the alcohol may then be recovered for distillation.

The drying apparatus consists of a pan into which the cleansed sugar is to be put. This pan stands upon another containing water, through which convoluted steam pipes pass, and heat the water so as to dry the sugar without injuring it. A cover may be fitted upon the sugar pan to collect and condense the alcohol which will be evaporated from it.

There are many parts to which we have scarcely alluded; the whole, however, are very perfectly represented in the drawings, which, with the specification, exhibit the plan of operating in a very perspicuous manner.

The claim is not to the separate parts, but to that combination and arrangement of the apparatus described, by which the ends proposed are effected.

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52. For improvements in the combination of *Machinery for regulating Heat;* Lemuel Wellman Wright, a citizen of the

United States, now residing in the city of London, England, August 25.

This apparatus is intended to regulate the heat which shall be admitted into hot houses, drying houses, manufactories, dwellings, or any other place where it is required. The principle upon which this regulator acts, is the unequal expansion of metals. If a bar of zinc, and another of steel, are firmly united together throughout their whole length, this compound bar will be curved by any change of temperature. If heated, the greater expansion of the zinc will cause it to form the convex side of the curve, and this convexity will be proportioned to the elevation of the temperature.

Suppose two of these compound bars to be rivetted together by a single rivet in the middle of them, with their zinc sides in contact, these bars will then recede from each other at their ends, by any elevation of temperature; and if these ends be united by joints to the ends of similar bars, their combined action will increase the effect. An apparatus of this kind may be made to open and close a damper, and thus regulate the admission of heat. Several modifications of the instrument are proposed, but all acting on the same principle. We shall hereafter notice a similar arrangement proposed by Dr. Ure.

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53. For a machine for *Making Clapboards from Round Logs;* Herald Whittemore, Worcester, Worcester county, Massachusetts, August 26.

On the 26th day of March, 1820, Messrs. Eastman & Jaquith, of Maine, obtained a patent for a machine for the same purpose with the above. Circular saws are used to cut a round log from the outside towards the centre, which, of course, makes the boards feather edged. This machine has been since improved, both by the inventor, and others, and the present patent purports to be a still further improvement. The saw is to consist of four plates of steel, fixed upon the face of a blank wheel, and projecting from it about nine inches; but as they are secured to the wheel by screws passing through slots, their length can be altered. Each exterior end of these four plates has two teeth upon it. From the mode of forming it, it may be called an expanding circular saw.

The apparatus for turning the log, and drawing the carriage back, and its other parts, are described at much length; they are more complex than in the original machine, and we do not perceive any thing about it which should secure it a preference.

The patentee claims as his improvements, the application of blades of steel with teeth to an iron blank wheel; the raising and turning friction rollers; and his particular mode of gearing.

On examining the description of Eastman & Jaquith's machine, published in the fifth volume of Silliman's Journal, it will be found that the principle and general arrangement of the two, are perfectly similar.

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54. For an improvement in the *Machine for Manufacturing*

of Shingles; William Thomas, Farmington, Muskingum county, Michigan Territory, August 26.

There have been several editions of this machine, and but for the date, we should think this one of the oldest. A wheel with cutters upon its periphery, is to revolve upon a shaft. It is to be so contrived as to cut the shingles tapering; by what means, however, we are not told. There is no claim made.

There are a number of good machines for making shingles in useful operation; the present, we are convinced, will not be found to interfere with them.

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55. For an improvement in *Rustall's Family Mill,* called the "Vertical Family Mill;" Elijah Skinner, and John Webster, Sandwich, Strafford county, New Hampshire, August 26.

In this mill the two stones are placed vertically, and they are both made to revolve, but in opposite directions. The claim to "improvement, is the revolution of both stones in opposite directions, and the method of feeding through the shaft."

The feeding through the shaft is effected by a screw, or spiral, formed round it, which serves to carry the grain in between the stones, the horizontal position of which renders such a provision necessary. This machine adds another to the list of portable mills, but presents no claim to a preference; that which it makes to novelty, in the running of both stones in opposite directions, has been long since made, and that more than once or twice.

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56. For a *Fly Wheel Press;* David Evans, city of Philadelphia, August 26.

The description of this press does not describe it; and but for the drawing we should know but little of its various parts. It, however, is represented by the pencil of Mr. Wm. Mason, of Philadelphia, in that style of excellence which distinguishes all his labours in this way.

To this press there are two screws, the heads of which rest on its head block, near to its ends. There is a washer, or collar, upon the shanks of the screws below the head block, which serve to support it. The nuts are in the bed piece, or bottom of the press. Upon the head of each screw there is a cog wheel; between, and turning them both, there is a pinion, all, of course, lying horizontally. An axis rises vertically from the middle of the head block, and upon this the pinion turns. Above the pinion, there is a cap which operates as a ratchet wheel, and on the top of this cap there is a horizontal fly wheel. The pinion is to be turned by a lever passing into a socket on the ratchet wheel cap. In pressing, the lever operates upon the pinion through the medium of the ratchet, whilst the lever may be turned back for a new purchase without withdrawing it from the socket.

This is called a fly wheel press, but we are at a loss to discover any real use in this appendage. When the screws are to be brought

down to their bearing it offers some advantage, as the motion may then be rapid; but in some other cases, it must be disadvantageous. We see no provision for turning the screws back, and this cannot be done by the lever whilst the rachet is in operation. There are slides in the usual situation of the cheeks, which serve to steady the cap and follower, or platten, in their descent.

The press patented by Charles Evans, of Philadelphia, June 13th, 1831, see last volume p. 346, has two screws, operating as cheeks, and these are specially claimed in a way which appears to embrace the principle of the present patent.

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57. For an improvement in the mode of *Making Bee Hives, and Managing Bees;* Abijah Alley, Cincinnati, Hamilton county, Ohio, August 26.

Each hive, or bee house, is to consist of three compartments, separated from each other by a floor, or partition, furnished with slides, which may be drawn out, or closed, at pleasure. After the bees have filled the upper compartment, the slides are to be closed, and they then work, in the next below, and so on until the whole are filled. The comb and honey may be removed from those compartments which are filled, without destroying the bees.

Hives were constructed in this way at least half a century since, and although the plan may be new to the patentee, it is old to all those who have fully informed themselves respecting the history and mystery of bees.

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58. For a *Hydrostatic Safety Valve* for the boilers of steam engines; Thomas Ewbank, city of New York, August 27.

(The specification was published in the last No.)

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59. For *Cutting Tenons by Revolving Cylinders;* Josiah Fay, Hollis, Hillsborough county, New Hampshire, August 29.

Two cylinders are made to revolve, one above the other, and are capable of being removed nearer together, or further apart. Upon their faces they carry cutters, in the form of plane irons set askew, and from their edges project small spurs, or cutters, which cut the shoulders of the tenons. The piece to be cut lies in the direction of the axes of the cylinders, upon a sliding frame prepared for the purpose.

The machine, as drawn, appears to be unnecessarily complex; an error by no means uncommon in the first formation of instruments of this kind. The patentee claims "the cutting of tenons by revolving cylinders," as his own invention or discovery.

The cylinders have their bearings behind that part upon which the cutters are placed, as these ends must stand out like a chuck in the mandril of a lathe, otherwise the piece to be tenoned could not pass between them.

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60. For a *Machine for filtrating Water and other Liquids;*

James Barron, Esq. of the United States'Navy, city of Philadelphia, August 30.

There is to be a tub which is to contain the water or other liquid to be filtered; the bottom of this tub is to be perforated in the centre, a circular hole being cut of any required diameter; into this hole a cylindrical vessel is to be fastened, the top of which will be flush with the bottom of the tub, and is to extend downwards as far as may be required. A grating is to rest upon a rim at the lower end of this cylinder, and another grating, filling the cylinder, is to be fixed on the bottom of an iron screw rod. A bar crosses the top of the tub, and has a female screw in its middle, through which the screw rod works, being turned by a crank at top. Into the cylinder pieces of sponge are to be put, and these by turning the screw rod, will be compressed between the two gratings: this pressure is to be such that water, or other liquid, will just pass through. The quantity of sponge may be varied, as also may the pressure, until that which is found best is obtained.

The claim is to "the before described machine for filtrating water and other liquids through sponge compressed." We apprehend that it would have given greater security, had the patentee claimed the filtering of water through compressed sponge, by means of the foregoing machine, or any other acting upon the same principle, as it certainly would not be difficult to construct a machine, different in its form, and in the arrangement of its parts, in which the same effect should be produced.

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61. For a *Washing Machine;* Jesse Barber, Sweden, Monroe county, New York, August 30.

A trough is to be made, the bottom of which is to consist of rounds, placed so as to form the segment of a circle. A frame is to vibrate over these rounds, suspended as in many other patent washing machines; rounds are to be attached to the bottom of this frame to act upon the clothes; so far all is old enough; but the novelty claimed is the allowing half the rounds which form the bed, and half those which form the vibrating segment to roll on pivots at their ends, whilst the others are made fast. The next inventor may leave one-fourth at rest, and allow three-fourths to turn.

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62. For a *Churn;* Zuri S. Doty, Bridgewater, Susquehanna county, Pennsylvania, August 31.

This, we are told, "may with propriety be called a self-propelling machine," although a person must be constantly employed to turn a crank. A heavy fly wheel is to run vertically, and upon its shaft there are to be two cranks standing in opposite directions; these are to work two levers, the opposite ends of which act upon the dashers. The churn is of the ordinary vertical kind, but the dasher is divided into two parts, one of which ascends, whilst the other descends.

What there is of novelty in this invention is left to conjecture, there being no claim, and we opine that it possesses but little of this

ingredient. We could point to several churns which operate very much like this, but have no time to devote to an inquiry so little likely to be useful.

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63. For an improvement in the *Application of the Wheel, Pinion and Crank, or Pulley, to the Screw in Pressing;* Joseph Tickler, Massillon, Stark county, Ohio, August 31.

This is the common screw press, in which a wheel and pinion are used to act upon the screw. There is to be a horizontal shaft upon which a pinion is to be placed; this pinion takes into a horizontal crown wheel at the head of the screw. In the follower there is a nut in which the screw works, and causes it to descend. The shaft carrying the pinion may be turned by a crank, and upon this shaft a whirl, or pulley, is fixed, for the purpose of suspending a weight by a cord from its periphery, where continued pressure is wanted, as in pressing cheese.

There is no claim made, the patentee probably supposing that the application is altogether new. Many presses, however, have been made in which the power of the wheel and pinion has been employed in the working of the screw.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improvement in the construction of the axles or bearings of rail-way, or other wheeled carriages. Granted to ROSS WINANS, *city of Baltimore, July* 20, 1831.

To all whom it may concern, be it known, that I, Ross Winans, have invented an improvement in the construction of the axles, or bearings, of rail-way, or other wheeled carriages, and that the following is a full and exact description thereof.

The axle, with my improved journals, or bearings, may be made straight, and the wheels placed thereon in the usual way; but instead of forming the bearings under the body of the carriage, and within the naves, or hubs, of the wheels, there to sustain the weight of the load, I extend the axles out at each end, projecting beyond the naves to such a length as shall enable me to form them into gudgeons. The lengths and diameters of these gudgeons, I regulate according to the load they are intended to sustain, and to other circumstances. In all cases, however, the value of my invention depends upon the gudgeons having their diameters as small as a due attention to the strength required will allow. The causing the axles to run in boxes, or upon bearings without the naves, admits of their being made much smaller than usual, the degree of diminution which I have found to answer well in practice, will hereafter be stated. They should be formed of good wrought iron, and case-hardened; or overlaid, or cased, with the best steel and hardened, which materially diminishes the extent of bearing surface necessary to enable them to receive and resist the pressure of the load, and their tendency to wear; they may

therefore be short, and are consequently strong, when of, comparatively, very small diameter.

The tendency to lateral movement is checked, or limited by forming the end, or point of the axle, or gudgeon, so as to be met occasionally by the external cap, or cover, of the gudgeon box, when lateral pressure occurs.

By placing the bearing outside, (as aforesaid,) the diameter of the wheels may be enlarged with more advantage than formerly, as the axles between the wheels may be made of any required strength, (to resist the increased stress thrown on to that part of them by an enlargement of the wheels,) without affecting the size, or strength, of the bearing journals.

By the foregoing means, the leverage of the wheels, (or the mechanical advantage with which the moving power acts, to overcome the resistance to motion,) is increased, and consequently the friction or resistance to motion in rail-road carriages, diminished to a greater extent than heretofore.

This improvement in the axles and journals of rail-way carriages, was devised and carried into operation on my experimental rail-way, and exhibited to various persons in the early part of the year 1827; and it was put into practical operation, under my direction, on the Baltimore and Ohio, and on the Liverpool and Manchester, rail-roads, in the early part of 1829, in connexion with another improvement for the further diminution of friction, by means of a revolving bearing, or friction wheel, for which other improvement a patent was granted to me on the 11th of October, 1828.

I constructed for use, on the latter of the before mentioned roads, a number of cars with the axles and journals, or gudgeons, of various descriptions and dimensions; the gudgeons, or immediate place of bearing for the load, varied from 1¼ to 2¼ inches in diameter, and from 1¾ to three inches in length. Some of them were made of wrought iron, and case-hardened, and some of iron overlaid with steel and hardened. The axles between the wheels were mostly of wrought iron of from 2½ to three inches in diameter. Several cars, however, were constructed with hollow cylindrical cast iron axles, secured to the wheels by flanches on the ends of the axle, and bolts, the gudgeons being separate pieces firmly fixed into the naves of the wheels. (Wood may also be used for the axle to keep the wheels in their parallel relation to each other, with steeled gudgeons, as aforesaid, to receive the bearings.)

The result of experience by the practical use of those cars for the conveyance of loads from three to six tons, and under various circumstances, is that, (for the support of a given load,) the gudgeons or bearing for the load might, in the manner herein specified, be safely used of from one-third to one-half less in diameter than those in common use, without impairing, but rather increasing, the strength and durability of a car; and the diameter of the wheels finding a less early practical limit, it is evident that a saving in the moving power is effected, as the power acts at a mechanical advantage equivalent to the increased ratio of the diameter of the wheel to that of

the axle. These gudgeons, so constructed, were exhibited by me in England, as before stated, and have been adopted there without my deriving any advantage therefrom; as, by the laws of that country, I could not secure the invention by patent, after having publicly exhibited it.

The object of the invention, and a practical demonstration of its utility having been shown, its application and adaptation to the different rail-road carriages, burthen wagons, locomotive engines, &c. and to the different bearing boxes that may be preferred for different purposes, (either revolving, or common,) will be evident, and easy, to any person acquainted with the building of rail-way carriages. But to render it still more so, the following general directions and proportions are given, which I think will be found to be a near approximation to what will be required in practice. When it is intended to convey loads of from two and a half to three and a half tons, and to use wheels of from two and a half to three feet in diameter, the general diameter of the axles may be from two and three-fourths to three inches, and extending through and beyond the naves of the wheels on each side, far enough to go under and conveniently receive the side frame of the load bed, and to have their ends turned, or formed into gudgeons about two and a half to three inches in length, and from one and a half to two inches in diameter. On the four gudgeons thus formed, the carriage body rests by means of any hard metal bearings attached to the before mentioned side pieces; which side pieces are so framed with the cross pieces of the bed as to go on the outside of the wheels, either over or under the gudgeons, as convenience may require. The friction occasioned by the tendency to a lateral movement of the gudgeon is limited by causing the end cover of the bearing to meet the end of the gudgeon as near to the centre of action as possible. When my revolving box is intended to be used, this end is attained by forming the end perfectly square; and when the common box is used, by forming the end of the gudgeons convex or rounding.

In consequence of the small extent of bearing surface embraced by the bearing on the journal, the bearing box, (to guard against wear,) should be made as hard as the use of the most favourable materials for that purpose would permit. The oiling or lubrification of the gudgeons may be effected in any of the usual or convenient ways. But to guard as much as possible against the oil working from the gudgeons on to the rail wheels, it is adviseable to turn one or two small rings, or grooves, on a portion of the axle between the gudgeon and the nave of the wheel, which will obviate that difficulty. I do not intend to be understood as claiming all merely projecting axles with bearing beyond, or external to, the wheels; the single wheel of Sargeant's and of Palmer's rail-way carriage, for single rail-ways, had projecting axles, and several kinds of rail-way carriages have been devised with four wheels, each having separate axles, with both inside and outside bearings, with a view to turning curves with facility. A carriage was made at Liverpool, in England, at a later date than my invention, with outside bearings of the usual size for the pur-

pose of using a broad body, temporarily, and without any view to the object of this improvement, nor effecting the like purpose. My invention is sufficiently distinguished from all others before known and used by the new and useful effect produced in the manner aforesaid.

I therefore declare that the improvement, or improvements, above explained and described, in diminishing the resistance to motion in wheeled carriages to be used on rail-ways, which I claim as my own invention, is the extending the axles each way outside of a pair, or pairs, of wheels, far enough to form external gudgeons to receive the bearing box of the load body, and diminished as aforesaid, with a view to lessen the resistance of friction, as small as its situation, with the use of the most favourable metal for wear, will permit. Thus conveniently increasing the leverage of the wheels, without impairing their effective strength or durability.

Ross Winans.

Fig. 1.

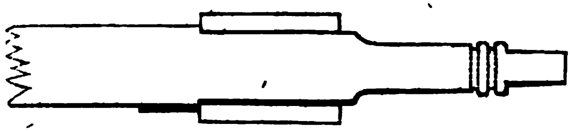


Fig. 2.

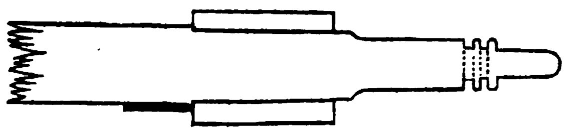


Fig. 1. Axle with flat end.
Fig. 2. Axle with round end.
The dotted lines show the rings or grooves.

Specification of a patent for an improvement in Lamps for the combustion of evaporable fluids. Granted to Isaiah Jennings, *of the city of New York, August* 1, 1831.

To all whom it may concern, be it known, that I, Isaiah Jennings, of the city of New York, have invented an improvement in the common lamp, which adapts it especially to the combustion of the combination of alcohol and spirits of turpentine, and of other essential oils and ingredients, for the use of which ingredients letters patent of the United States have been already issued to me, and which improvement in the lamp is also applicable to the combustion of other evaporable ingredients not specified in the letters patent above alluded to. And I do hereby declare that the following is a full and exact description of my said improvement in the lamp.

Instead of a tube, constructed in the ordinary manner, for con-

taining the cotton, or other wick, which is in them allowed to project through the tube, or burner, and lighted at the top thereof, I make a brass, or other tube, which I cause to rise to a much greater height above the reservoir, or body, of the lamp than is usually done, say, for example, to the height of two inches. The upper end of this tube I close entirely, or simply drill a small hole through, of such size as may suit the ingredients to be burnt, but not generally exceeding one-thirtieth of an inch in diameter. Through the sides of the tube, and at about half an inch, more or less, from its lower end, where it joins the body of the lamp, I drill four, or any other number of similar holes.

A tube thus constructed forms the principal feature of my improvement; and in order to use this lamp, I insert a wick of cotton, a bundle of fine wire, or of any other fibrous material which will raise the fluid from the lamp by capillary attraction; allowing the wick to raise to the upper end of the tube, and to descend into the fluid the vapour of which is to be burnt.

When this lamp is to be lighted, all that is necessary is to apply flame to the small openings above described, when the vapour which escapes therefrom will be inflamed, and the heat generated by this inflammation operating upon the tube, will increase the evaporation so as to produce a brilliant light, without the destruction of the wick, or other fibrous substance.

What I claim as new, and as my improvement in this lamp, and which is applicable to such lamps as are now in use, is the tube, or burner, for containing the wick, or other fibrous substance, constructed in the manner, or upon the principles, hereinbefore explained.

ISAIAH JENNINGS.

The first English Steam-boat.

THE following description of the first steam-boat, with the accompanying drawing, is extracted from an interesting little pamphlet just published by Mr. Effingham Wilson, entitled "An Account of the Origin of Steam-boats, in Spain, Great Britain, and America; and of their introduction and employment upon the River Thames, between London and Gravesend, to the present time." In enumerating the early practical philosophers of that sublime agent, steam, we regret that the author of the pamphlet has omitted to include the name of the French engineer, PAPIN. If the writer be not already apprised of this inaccuracy, he will find an account of the man and of his work, in the "*Recueil Industriel,*" No. 54, for last June,* in one of the series of papers upon steam engines, written by Monsieur Arago, who, with some show of justice, claims, on behalf of Pepin, the honour of being the first to apply the agency of steam for the purposes of navigation.

Jonathan Hulls' work was printed in the year 1737, Papin's in 1695—42 years anterior to Hull's. In a subsequent edition of his

* See vol. iv. of this journal, p. 363.

entertaining and tasteful little book, our author will doubtless refer to the paper we have quoted, and, (if he feel that Monsieur Arago has made out his case,) render justice to the foreigner, on the score of priority of invention. At all events, this is the earliest known drawing of a steam-boat.

"The object now to be noticed, is the first steam-boat projected in Great Britain, by Jonathan Hulls, who obtained a patent for his invention, dated the 21st day of December, 1736.

"In the following year he published a tract,* containing a description of his machinery, the title of which is presented to the reader at length, as it contains the interesting fact in the history of steam navigation, that the first attempt was directed to the single purpose of towing ships. 'A description and draught of a new invented Machine, for carrying Vessels or Ships out of, or into, any Harbour, Port, or River, against Wind and Tide, or in a Calm, for which his Majesty has granted Letters Patent, for the sole benefit of the Author, for the space of fourteen years. By Jonathan Hulls. London: Printed for the Author. 1737.'

"From this authentic source the most ample details may be obtained; and in justice to the ingenious inventor, such as it is adviseable to extract shall be given in his own words.

"The author introduces the description of his engine and the boat machinery, with the following general observations:—'Whereas several persons concerned in the navigation have desired some account of my invention for carrying ships out of, and into, harbours, ports, and rivers, when they have not a fair wind. But I could not fully describe this machine without writing a small treatise of the same, in which I shall endeavour to demonstrate the possibility and probability of the matter undertaken. There is one great hardship lies too commonly upon those who propose to advance some new, though useful scheme, for the public benefit. The world abounding more in rash censure, than in a candid and unprejudicial estimation of things, if a person does not answer their expectations in every point, instead of friendly treatment for his good intentions, he too often meets with ridicule and contempt. But I hope this will not be my case, but that they will form a judgment of my present undertaking only from trial. If it should be said that I have filled this tract with things that are foreign to the matter proposed, I answer, there is nothing in it but what is necessary to be understood by those that desire to know the nature of that machine that I now offer to the world, and I hope that, through the blessing of God, it may prove serviceable to my country.' Then follows a long explanation, with definitions and demonstrations of the nature of the powers called into action, for which the reader is referred to the work itself; omitting the full recital here, because

* This tract has been reprinted by Mr. Partington at the end of his Lectures on the Steam Engine, and it is introduced there with the following note. "This highly curious tract, which the editor has been permitted to copy, throws considerable light on the history of steam navigation. Its great rarity, however, has hitherto prevented its contents becoming generally known to the scientific world, a single copy having been sold for more than *three guineas*."

it is more desirable to proceed at once to the description of the boat and machinery."

Fig. 1.

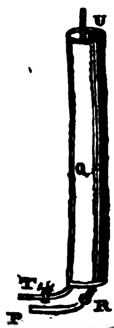
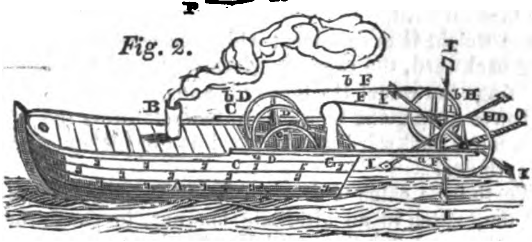


Fig. 2.



Explanation of the wood engraving representing the first Steam-boat projected in England.

Fig. 1.

In some convenient part of the tow-boat there is placed a vessel about two-thirds full of water, with the top close shut. This vessel being kept boiling, rarifies the water into steam; this steam being conveyed through a large pipe into a cylindrical vessel, and there condensed, makes a vacuum, which causes the weight of the atmosphere to press on this vessel, and so presses down a piston that is fitted into this cylindrical vessel, in the same manner as in Mr. Newcomen's engine with which he raises water by fire.

P. A pipe coming from the furnace to the cylinder.

Q. A cylinder.

R. A valve that stops the steam from coming into the cylinder, whilst the steam within the same is condensed.

S. A pipe to convey the condensing water into the cylinder.

T. A cock to let in the condensing water when the cylinder is full of steam, and the valve P is shut.

U. A rope fixed to the piston that slides up and down the cylinder. This rope, U, is the same that goes round the wheel D in the machine.

Fig. 2.

A. The tow-boat.

B. Chimney coming from the furnace.

C, C. Two pieces of timber framed together, to carry the machine.

Da, D, Db. Three wheels on one axis, to receive the ropes F, Fa, Fb.

Ha, Hb. Two wheels on the same axis with the fans I, I, I, I, I, I, which move alternately in such a manner, that when the wheels Da, D, and Db, move backward or forward, they keep the fans in a direct motion.

Fb. A rope going from Hb to Db, that when the wheels Da, D, and Db move forward, moves the wheel Hb forward, which brings the fans forward with it.

Fa. A rope going from the wheel Ha to the wheel Da, that when the wheels Da, D, and Db move forward, the wheel Ha draws the rope F, and raises the weight G, at the same time that the wheel Hb brings the fans forward.

When the weight G is so raised, while the wheels Da, D, and Db, are moving backward, the rope Fa gives way, and the power of the weight G brings the wheel Ha forward, and the fans with it, so that the fans always keep going forward, notwithstanding the wheels Da, D, and Db, move backward and forward as the piston moves up and down the cylinder.

L, L. Teeth for a catch to drop on from the axis, and are so contrived that they catch in an alternate manner, to cause the fans to move always forward, for the wheel Ha, by the power of the weight G, is performing its office, while the other wheel Hb goes back in order to fetch another stroke.

The weight G must contain but half the weight of the pillar of air pressing upon the piston, because the weight G is raised at the same time as the wheel Hb performs its office, so that it is in effect two machines acting alternately by the weight of one pillar of air, of such a diameter as the diameter of the cylinder is!

[*Rep. Pat. Inv.*

Improved Dividing Machine.

The Society of Arts have this month awarded their Gold Isis Medal to Mr. Andrew Ross, for some extremely ingenious and useful improvements in the dividing machine.

The first improvement consists in a new mode of obtaining the divisions for circular dividing engines, depending, in the main, on the same principles as have already been employed, but varying in some of the details. Mr. Ross first divides his circle into forty-eight parts, by continued bi or tri sections, or by a combination of each method. The points thus formed being carefully marked on the limb of the circle, the intervals are then subdivided in the following manner:—An arc, equal to one of the spaces to be subdivided, is procured,

and is divided accurately, and to the same degree of minuteness as it is intended to divide the plate of the engine. The radius of this arc is to be equal to that of the engine, and whatever errors there may be in its original divisions, are to be corrected by the following process. A second arc, having an angular value equal to the first, with a radius only one-half or one-fourth as great, is, together with the first, attached and made concentric with the plate of the engine. The divisions of the first are transferred by means of radial lines to the second, the spaces between them being diminished, of course, in proportion to the radii of the respective arcs. When the second arc has received a counterpart of the divisions of the first, it is placed on the circumference of the engine plate, and there fixed, so that the divided arc shall occupy exactly its proper angular space on the limb of the plate. The divisions of the second arc are then transferred to the first or larger one, a single interval on this latter comprising two or four on the former, according as the radius of the one is twice or four times as great as that of the other. In this manner, the errors of any particular intervals become gradually distributed among the rest, and by repeating the process a sufficient number of times are reduced to invisible quantities.

The second branch of Mr. Ross's improvements, consists of the apparatus by which the divisions of the engine plate, corrected as above described, are transferred to the arc of circles of other instruments. This is usually done by means of small teeth, cut on the edge of a large horizontal wheel: these teeth being acted upon by an endless screw, about an inch in diameter. The truth of such an engine depends, first, on a perfect equality between all the teeth in the wheel; and secondly, in an equality in all parts of the spiral formed by the threads of the screw, as well as in the inclination of those threads. The obstacles to perfect success in these particulars arising from slight differences in the density of the metal, or in the sharpness of the cutter, are such as have perhaps never been overcome entirely by the most celebrated artists, however nearly they may have approached it; and the wheel and screw, when once out of the maker's hands, are no longer susceptible of any correction, whatever errors may be discovered.

Mr. Ross's engine consists likewise of two parts, which act as a toothed wheel and endless screw, but so constructed that each tooth of the wheel, and every part of the screw, admit of unlimited correction and adjustment by the person using it. The teeth of the wheel are only forty-eight, and consist of brass cogs into which are tapped steel screws, the axes of which lie in the plane of the wheel, and are at their ends tangents to the circumference. These ends being ground perfectly flat form the virtual faces of the teeth, and capable of being at any time advanced or withdrawn, give, therefore, to the wheel that perfect and constant power of adjustment which has been mentioned. The same power is obtained for the endless screw, by forming it of one deep thin thread, winding round a cylinder four or five inches in diameter. Into this thread are tapped ninety screws, at equal distances, having their axes parallel with the

plane of the cylinder: the ends of these screws forming the stops to those in the cogs of the wheel, and like them, are capable of easy and unlimited correction. Thus the circumference of the wheel is divided into 4.320 equal spaces, every one of which may afterwards be corrected if required. [*Mec. Mag.*

Meteorological Observations for December, 1831.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches.				Inches.	
	1	22°	30°	29.70	29.80	16	W.	Calm.		Clear—cloudy.
⊗	2	16	26	30.05	30.05	11	W.	Moderate.		Clear day.
	3	30	32	29.80	29.90	15	W.	Blustering.		Cloudy—clear.
	4	14	28	30.24	30.24	7	NW. SW.	Moderate.		Clear day.
	5	28	36	30.05	30.00	25	SSW. SW.	do.		Cloudy day.
	6	38	45	29.80	29.75	28	SW. W.	do.	.52	Fog—rain.
	7	32	33	30.00	30.10	27	N. NE.	do.		Cloudy day.
	8	29	32	30.05	29.85	32	E. SE.	do.	1.80	Cloudy—rain.
	9	38	42	29.30	29.00	33	W.	Blustering.		Flying clouds—rain.
☽	10	28	42	29.70	29.70	33	W. SW.	Moderate.		White frost: cl'r. overcast
	11	30	33	29.60	29.60	20	W.	Blustering.		Cloudy day.
	12	18	26	29.94	30.00	8	W.	do.		Clear day.
	13	23	48	30.00	30.00	30	SW. SW.	Moderate.		Clear day.
	14	35	49	30.15	30.20	31	W.	do.		Clear day.
	15	34	50	30.24	30.24	32	W.	do.		Clear day.
	16	33	50	30.24	30.20	35	W. NW.	do.		Clear day.
☺	17	30	48	30.15	30.10	37	NE. SE.	Calm.		Cloudy; hazy; rain in n't.
	18	44	56	29.99	29.90	50	SW. SW.	do.	.3	Cloudy; clear; rain in n't.
	19	51	56	29.80	29.83	39	SSW. W.	Blustering.	.1	Flying clouds—clear.
	20	38	46	30.05	30.05	29	W.	Moderate.		Cloudy; cl'r; snow in n't.
	21	32	36	29.85	29.90	30	W.	do.	.21	Cloudy—flying clouds.
	22	20	30	30.20	30.20	13	N.	do.		Clear day.
	23	16	33	30.30	30.20	19	NE. E.	do.		White frost—clear.
☾	24	25	44	30.00	29.90	38	NE.	do.		Clear—cloudy.
	25	36	26	29.63	29.60	26	W.	do.	.81	Rain—snow.
	26	4	8	30.10	30.29	6	W.	do.		Clear day.
	27	—5	8	30.30	30 30	5	W.	do.		Clear day.
	28	2	25	30.30	30.20	12	SW. SW.	do.		Clear—cloudy.
	29	22	31	30.29	30.10	19	NE. S.	do.		Cloudy day.
	30	24	38	29.60	29.60	33	NE. NW.	do.	.60	Rain.
	31	20	32	29.90	29.94	19	W.	do.		Cloudy—clear.
	Mean	26.07	34.48	29.96	29.95	24.6			3.98	

	Thermometer.	Barometer.
Maximum height during the month,	56. on 18th & 19th.	30.30 on 27th & 28th.
Minimum do. . .	5. below zero on 27th.	29.00 on 9th.
Mean do. . .	30.27 . . .	29.97

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

MARCH, 1832.

On the flow of Water through Tubes.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

SIR,—The following solutions to some questions proposed to me by Mr. Frederick Graff, Esq. may perhaps prove interesting to some of the readers of the Journal of the Franklin Institute, and are therefore transmitted for publication.

Yours,
JAMES P. ESPY.

February 3d, 1832.

To FREDERICK GRAFF, ESQ.

DEAR SIR,—The answers to the following questions have been calculated at your request and are given below.

"What quantity of water will be discharged in twenty-four hours by a tunnel five feet clear in diameter, twenty-eight miles long, descending eighteen inches in each mile—starting with a head of twelve inches above the top of the inside of the culvert?"

Also, "What quantity of water will be discharged in twenty-four hours by an iron pipe thirty inches clear in diameter, of the same length, and the same head and fall?"

The first, I find, will discharge 20,649,600 gallons, and the second will discharge 3,650,400 in a day.

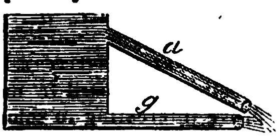
The calculation is made on the supposition that the tubes are perfectly straight and cylindrical, so as to cause no eddies, and permit no air to lodge in the upper parts of bends, which, if permitted, would materially diminish the discharge.

The formula used in the calculation is derived from experiments detailed in the Edinburgh Encyclopædia—art. Hydrodynamics—and may be expressed thus:

Let d be the diameter of the culvert or tube; h, the total head and fall of water, or the height of the water in the reservoir above the middle of the lower end of the pipe; l, the length of the pipe, or tunnel, all in inches; then the velocity in inches per second with which the water will flow in the pipe, will be v.

$v=23\frac{1}{4}\sqrt{\frac{57hd}{l+57d}}$, which in the first case, by calculating, I find to be twenty-three inches and nine-tenths per second; and in the second case $16\frac{9}{10}$ inches.

Now twenty-three inches and nine-tenths per second will give 57,360 yards per day, and as it is known that a cylinder of water one inch in diameter, and ten yards long, is one gallon, it will follow that each yard of the culvert, sixty inches in diameter, contains 360 gallons; but 360 multiplied by 57,360, the number of yards passing through the large tube in a day, gives 20,649,600, as before. In like manner, one yard of a thirty inch tube contains ninety gallons, and the velocity through this pipe of $16\frac{9}{10}$ inches per second, gives 40,560 yards per day, and this multiplied by ninety gives 3,650,400 gallons per day.



You will perceive the calculation is made on the presumption that it is indifferent whether the water be taken out of the bottom of the reservoir, as g, or near the top with a sloping tube, as at a. I see no reason to believe there is any difference, provided there is head enough in the latter case to flow in as fast as it can run through the tube.

By a similar calculation, I find if the sixty inch tunnel, with a similar slope, is only thirteen miles long, the velocity of discharge will be 24.78 inches per second, and will therefore discharge in twenty-four hours 21,330,000 gallons. In like manner it will be found that a tube of twenty inches in diameter, four miles long, with a head and fall of one hundred feet, will discharge about one-sixth more water than three tubes of twelve inches in diameter of the same length with a similar head and fall.

Yours, respectfully,
J. P. Espy.

Notes of an Observer.—*On the futility of the attempt to communicate mechanical power to a distance through air tubes.*

Dr. Robison, in his third volume of Mechanical Philosophy, gives an account of an attempt made by Dr. Papin to use condensed air as a mechanical power. The failure was complete: I propose to investigate the cause.

He proposed to raise water out of a mine by a water power at the distance of a mile from the mine. He employed the water to drive a piston which should compress the air in a cylinder, communicating by a long pipe with another cylinder at the mouth of the mine. He expected that as soon as the piston at the water power had compressed the air to a certain extent in the tube, it would rush into the cylinder at the mine, force up its piston, and thus work the pump, discharging the water from the mine.

The machine, however, would not work, and as he attributed the failure to the immense quantity of air in the tube, he diminished the diameter of the tube, and arranged his water power so as to exhaust the air, believing that the immense velocity with which air rushes into a vacuum, would make a rapid and effectual communication of power. But he was as entirely disappointed in this arrangement, as he was in the other. Experiments of this kind were made both in Westphalia and Auvergne.

Notwithstanding this failure was complete, an engineer, many years afterwards, "erected a machine, in Wales, at a powerful fall of water, which worked a set of cylinder bellows, the blow-pipe of which was conducted to the distance of a mile and a half, when it was applied to a blast furnace. But although care was taken to make the conducting pipe completely air tight, of great size, and as smooth as possible, it would hardly blow out a candle. The failure was ascribed to the impossibility of making the pipe air tight. But what was surprising, above ten minutes elapsed after the action of the pistons in the bellows before the least wind could be perceived at the end of the pipe; whereas, the engineer expected an interval of six seconds only."

If we take a particular case, and calculate the resistance of air moving through pipes according to acknowledged principles, we shall find that there is nothing mysterious in the above results. It will be found that if the blow-pipe is three inches in diameter, and only a mile long, the air at one end must be kept constantly condensed by a pressure equal to $5\frac{4}{10}$ atmospheres, to produce a velocity of 128 feet per second. And yet this velocity gives only 2,304 gallons per minute, only about half the quantity used in the furnaces of Europe; for, according to Dr. Robison, a blast furnace there expels 720 cubic feet of air per minute.*

If we calculate the velocity of water issuing from a pipe one mile long and three inches in diameter, under a nine feet head and fall, according to the formula given in the preceding article, it will be found to be one foot per second.

Now as equal velocities are generated in all fluids by equal heads, all other circumstances being equal, it will follow that a nine foot head of air, or one eight-hundredth of a head of nine feet of water, will generate in air a velocity of one foot per second in a tube three inches in diameter, and one mile long.

Again, it is known, both from theory and experiment, that the heads of pressure generating velocity in fluids, are as the squares of

* Mechanical Philosophy, vol. viii. p. 784.

the velocities. Now the square of one is one, and the square of 128 is 16384, therefore the head of pressure due to the velocity of 128 feet per second, is obtained by the following proportion, as 1 : 16384 : : 9 to 147456, and this number divided by 800 gives 184$\frac{1}{3}$, equal to a pressure of 5$\frac{4}{10}$ atmospheres, as was said above.

Now if we suppose this velocity doubled, or 256 feet a second, in order to discharge air enough to supply a blast furnace, the head of pressure will be four times as great, or upwards of twenty-one atmospheres.

This would require a machine equal to a thirty-four hundred and twenty-six horse power, provided a horse can work eight hours a day, and raise one hundred and forty pounds, two hundred feet per minute. Perhaps it may be thought that the great pressure on the inside of the tube will still further increase the resistance; such, however, is not the fact, for it is known that the same quantity of water will be discharged through a curved tube under a given head, whether the curve is vertical or horizontal, thus proving that the increased pressure when the curve is vertical does not increase the resistance. Indeed the diminished velocity which results from increased density in the tube, would indicate, from theory, a diminished resistance.

The precise effect of increased density and diminished velocity, I shall discuss at some future occasion. Enough has been said to show that it is utterly vain to attempt to transmit mechanical power to any great distance through pipes by means of air.

FRANKLIN INSTITUTE.

Reports of the Judges of the Seventh Exhibition of the Franklin Institute.

Report of the Judges on Musical Instruments.

The judges on musical instruments respectfully report, that they have carefully examined the several instruments committed to their notice, and beg leave to present their *unanimous* opinions, as follows:

No. 433. A square piano of three strings, made by Loud & Brothers, merits attention, being in many respects a superior instrument, possessing durability, and brilliancy of tone.

No. 435, is a square piano, made by Loud & Brothers, of superior, but delicate tone, and well calculated for the voice.

No. 471, is a semi-upright piano, made by J. J. Mickley, of excellent workmanship, and of a silvery, soft, and brilliant tone, but too weak.

No. 485, is a square piano, made by —— Geib, of New York, of a bold and powerful tone, and considered a good instrument.

No. 324. A square piano, made by Conrad Myer, possesses some merit, with the middle tones of good quality.

No. 343. A square piano, made by E. N. Scherr, is a good instrument, possessing brilliancy of tone, of good action, and remarkable for the superior finish of the internal mechanism. The fine open tone

of this instrument, is, (perhaps,) injured by the useless, but splendid, heavy exterior cabinet work.

No. 345, is a harp guitar, a new invention, made and patented by E. N. Scherr, to whose ingenuity the public is indebted for the production of so good and sweet an instrument, *which well deserves a premium.*

No. 344, is an harmonica, made by E. N. Scherr, that especially deserves commendation; this instrument is well adapted for the parlour or hall, of sweet, yet powerful tone, of most splendid workmanship in each and every particular, and in the opinion of the committee richly *merits a premium.*

No. 384. A flute patented by Mr. Cuddy, made by Firth & Hall, has many excellent qualities; the trumpet mouth is an improvement, possesses a perfect tone, and, in our estimation, is superior to No. 385.

No. 385. A flute made by E. Riley, New York, is of excellent workmanship, and possesses many good qualities.

No. 391. A metronome made and invented by Mr. Maelzell, is a good invention, and has proved, in many instances, to be of much value.

No. 198. The metrotone invented by Mr. Francis H. Smith, is an instrument of ingenious contrivance, capable of describing to a well cultivated ear, *seventy-two distinct sounds in one whole tone.* We consider this invention a useful one, as it will enable Mr. Smith to present to the public his grand harmonica in perfect tune.

No. 197. The grand harmonicon, or musical glasses, patented by Mr. Francis H. Smith, is a pleasing instrument, differing essentially from, and superior to, the musical glasses heretofore brought before the public. The quality of tone is rich, and with its sweetness combines great power. This instrument, we are of opinion, *deserves a medal.*

To the above, we, the judges, do respectfully affix our signatures.

William Norris, Jr.
Abraham Ritter.
J. C. B. Standbridge.

Report of the Judges on Chemicals.

The judges on chemicals report, that they have examined the articles in that department offered for exhibition, and submit the following remarks.

Chemicals from John Elliot, and Wetherill & Brothers—all these articles are of good qualities, and in most cases choice specimens have been selected. The sugar of lead from Wetherill & Brothers, is particularly to be noticed for its beauty.

Pyroligneous acid—M. & S. N. Lewis. This specimen is a concentrated acetic acid of considerable strength and purity. The manufacturers deserve much credit for the perseverance which they have

shown in introducing this valuable article, and the perfection in which they now make it.

Purified vegetable oils from J. M. Truman. These oils are very beautiful, that from cotton seeds, in particular, is a new and successful attempt. The committee subjoin a letter from the manufacturers, explaining the qualities, &c. of the oil. They have pressed twelve bushels of the seed, and think it yields from three quarts to a gallon per bushel. They have also a large quantity of the crude oil from the south, which they are now purifying. We understand that at the mill in Richmond two bushels of the seed yield three gallons of oil. The manufacturers here estimate the cost of expressing and purifying the oil to be fifty cents per gallon; so that it will, in all probability, become a very important article of trade.

The spermaceti of Charles Morgan of New Bedford, deserves notice for its extreme whiteness and dryness.

The oils of cantharadin and mustard seed, are said to be solutions in oil of the active principles of those substances separated by ether. The committee have no data from which to judge of their peculiar excellence.

The tonic mixture is a secret medicine, which the committee apprehend does not come within the views of the Institute in getting up this exhibition. If nostrums and secret remedies be admitted, the Institute will find that all who prepare them will seek to place them in the room merely to advertise them more publicly.

Respecting the remaining articles, the judges have nothing to observe.

Daniel B. Smith,
Henry Seybert,
Henry Troth,
Algernon S. Roberts.

Philadelphia, 10 *mo.* 8*th*, 1831.

Letter from Joseph M. & George Truman to the Judges on Chemicals.

Philadelphia, 10 *mo.* 7*th*, 1831.

In regard to the queries respecting cotton seed oil, as to quantity obtained, use, &c., we can inform you that from about three quarts to one gallon of oil can be obtained from a bushel of seed by two expressions, for both of which the seed should be moderately heated, either by means of steam or hot air; the heat from steam, however, is preferable, thereby preventing the danger of burning, which imparts a disagreeable odour, difficult to eradicate. The oil obtained is thick, and of a very dark brown colour, as may be perceived by the sample presented. When submitted to our process of refining, the loss in oil is from ten to twelve per cent., leaving a dark mucilaginous deposit, which, we believe, may be applied to useful purposes, particularly in the manufacture of soap. As the oil from cotton seed is nutritious we see no reason why it may not, on further purification, be used for the table; it has a drying property, but not sufficient for

the painter without additional means to make it more so; it does not burn as well as sperm oil; in burning it yields a clear flame, but requires more frequent attention to clean the wick than sperm oil does. We believe it may be used in the woollen manufacture to advantage. It is about equal to olive oil in withstanding the cold of our climate; the refined oil could be sold at one dollar per gallon—there is no deleterious substance used in the process of refining, and when completed no portion whatever of the substances used remains in it.

The sunflower seed oil is obtained, as that from cotton seed, by two expressions; the first cold, for the second the seeds are to be warmed by hot air. About one gallon of oil can be obtained from a bushel of good seed. The oil from the first pressing is much more pure than that from the second, and comes from the press with less colour, but the product of the second pressing becomes equally pure when refined. It is equal for burning to sperm oil, and will not freeze in our climate, and therefore is superior for that purpose to any oil in use; this oil, we believe, will answer for table use, as well as for the woollen manufacture, and for oiling machinery it is superior to olive oil, not corroding brass, &c. The oil would be worth from one dollar to 1 25 per gallon, paying for seed 62½ cents the bushel; it possesses a drying property, and has been used to advantage by a calico printer in preparing certain colours used by them.

In regard to queries respecting the refining of whale oil, we will simply remark, that our process of refining this oil is advantageous in a commercial point of view, being able to do it rapidly and certainly; we refined about 24,000 gallons of this oil during three months of the past summer; the oil is rendered much more pure and pale, and burns with a clear white flame, but requires attention. The process of refining does not alter its character as regards the resistance to the cold of our climate; it is altogether a summer oil. We have on hand about 1,500 gallons of this oil which we will sell at fifty cents per gallon.

Respectfully,

JOSEPH M. & GEORGE TRUMAN.

Report of the Judges on Cabinet Ware.

The judges on cabinet furniture, &c. having carefully examined the different articles submitted to their inspection, respectfully report:—

That the large sideboard deposited by Mr. Charles H. White, is an excellent piece of work, both as to design and usefulness, and although as being a member of the Board of Managers the regulations *forbid* any premium or compliment to himself, we would respectfully recommend the workman who displayed his abilities in making it, as worthy of some token of encouragement.

The wardrobe, loo table, pier tables, arm chairs, and sofa, are all fair specimens of Mr. White's style of work. The lady's dressing table, by Joseph Barry, is a good piece of work, and will bear inspection.

The toilet and lady's work table, by A. G. Quervelle, are handsome articles in his usual good style of workmanship.

The globe work table sent by Michael Bouvier, is a very neat article, and does credit to the workman who made it. Although we cannot commend the design or workmanship of the secretary and bookcase, sent by Mr. Robinson, yet from its being veneered with a fine specimen of our native ash, and having been made by an apprentice, who has not yet been two years at the trade, we recommend him as deserving some encouragement.

We have also examined the hair cloth, and pronounce it a good specimen of American manufacture.

The patent swelled windlass bedstead is also a real improvement, and deserves encouragement. The spring mattrass has been already proved to answer the purpose intended. The scrap table deserves particular notice for the exact arrangement of the figures; and the two japanned tables are also remarkably fine specimens of ornamental work. The three pieces of American oak, cut from the same log, by Mr. Ramage, show the appearance of the surface by being cut in different directions. We think the round table painted to imitate different woods the best specimen we have seen; it deceived some of the best judges.

Jos. B. Barry.
John Jamison,
Adam Ramage.

Philadelphia, October 7, 1831.

Chain Cables.

A question of some considerable moment has been presented to us, respecting the relative goodness of chain cables manufactured in this country, and those made in Wales. It appears that the American made cables are not to be trusted; not because the iron itself is not equally good with the foreign, but because there are some bad links in nearly every chain, that give way when submitted to the test which the imported cables will uniformly bear. It has been said that this is owing to the difference in the mode of making the links; that in Wales they are not touched with the hammer excepting whilst they are at a good red heat, and that they are consequently left in an annealed and tough state. We see some valid objections to this explanation, but whatever be the cause, whether the defect is in the iron master, or in the smith, it ought to be discovered, and the remedy applied. There is too much at stake, when a vessel is dependent for safety upon her cable, to admit of any one employing those in which the fullest confidence cannot be placed. We wish that such as are able would give us their views and experience upon this subject. If the difference under consideration is in the manipulation, and not in the iron, the facts in reference thereto may lead to valuable results in other branches of the iron business, such, for example, as the manufacture of boiler iron, and indeed of all articles where great tenacity is of essential importance.

Editor.

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, to ascertain, by experiment, the value of Water as a Moving Power.

(Continued from p. 39.)

TABLE R.

CHUTE No. 7.—*Undershot. Centre Buckets. Wheel running close to Breast. Bottom of Gate at bottom of Wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	14.75		14.75	0.75	360	45.69	405.69	41.5	31	12.60	4225	14.75	623187	168361	.267			Air vents open. Water thrown violently through them up to centre of wheel.
2					416	46.59	462.59		36	10.86	4750		700625	191974	.273	.273	10.86	
3					463	47.32	510.32		41	9.54	5500		811250	211782	.261			
4	12.00		12.00	1.00	257	44.06	301.06	41.5	28	13.96	4260	12.00	511200	124940	.244			The frictions for the small weights of experiments, 12, &c. were calculated upon the principles given in pages 78 & 79, vol. viii.
5					360	45.69	405.69		33	11.84	5100		612000	168361	.275			
6					463	47.32	510.32		39	10.02	6225		747000	211782	.284	.284	10.02	
7					519	48.21	567.21		45	8.70	7350		882000	235392	.266			
8					566	48.95	614.95		53	7.38	8350		1020000	255204	.250			
9	8.00		8.00	1.50	257	44.06	301.06	41.5	29	13.48	6700	8.00	536000	124940	.235			
10					360	45.69	405.69		35	11.16	7900		632000	168361	.266	.266	11.16	
11					463	47.32	510.32		52	7.52	10125		810000	211782	.261			
12	2.00		2.00	2.00	20	40.30	60.30	41.5	54	7.24	7060	2.00	141200	25024	.177			
13					48	40.74	88.74		59	6.62	7800		156000	36826	.240			
14					62	40.96	102.96		64	6.10	8200		164000	42727	.260			
15					76	41.18	117.18		66	5.92	8675		173000	51628	.298	.298	5.92	
16					146	42.28	188.28		127	3.08	16525		330000	81123	.245			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table S.—Part I.

Chute No. 7.—*Undershot. Centre Buckets. Wheel running close to breast. Bottom of gate at bottom of wheel.*

No. of Exper't.	Head of water above. Bttm. of gate.	Top of bkt.	Bttm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	23.00		23.00	1.00	566	45.95	611.95	41.5	20	19.54	4200	23.00	966000	253960	.262			Half the soling taken out, from behind each float board.
2					669	47.58	716.58		23	17.00	4525		1040750	297380	.285			
3					772	49.21	821.21		25	15.64	5050		1161500	340801	.293			
4					875	50.84	925.84		27	14.46	5675		1315350	384223	.294	.294	14.46	
5					978	52.47	1030.47		32	12.20	6550		1506500	427644	.284			Wheel worked smoothly; no water dashed over the soling.
6	20.75		20.75	0.75	360	42.69	402.69	41.5	23	17.00	3300	20.75	684750	167116	.243			
7					463	44.32	507.32		29	13.46	3850		798975	210537	.275	.275	13.46	
8					566	45.95	611.95		36	10.86	4750		985625	253960	.257			Three pounds deducted from friction due to weight of wheel; on account of half the soling removed.
9					669	47.58	716.58		43	9.09	5800		1203500	297380	.247			
10	20.75		20.75	1.00	566	45.95	611.95	41.5	22	17.76	4450	20.75	923375	253960	.274			
11					669	47.58	716.58		24	16.28	4850		1006375	297380	.295	.295	16.28	
12					772	49.21	821.21		31	12.60	5675		1177560	340801	.280			
13	17.75		17.75	0.75	257	41.06	298.06	41.5	26	15.00	3050	17.75	541375	123695	.228			
14					360	42.69	402.69		29	13.48	3675		652312	167116	.287	.287	13.48	
15					416	43.59	459.59		31	12.60	4050		718875	190730	.265			
16					463	44.32	507.32		36	10.86	4675		829812	210537	.253			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE 8.—PART II.

CHUTE No. 7.—*Undershot. Centre Buckets. Wheel running close to Breast. Bottom of Gate at bottom of Wheel.*

No. of Exper't.	Head of Water above. Btm. of gate.	Top of Bkt.	Btm. of Bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
17	17.75		17.75	1.00	430	43.81	473.81	41.5	23	17.00	4225	17.75	749930	196631	.262			
18					463	44.32	507.32		24	16.28	4300		763250	210537	.276			
19					566	45.95	611.95		27	14.46	4900		870750	253960	.292	.292	14.46	
20					669	47.58	716.58		33	11.84	5775		1024812	297230	.290			
21					772	49.21	821.21		40	9.77	7000		1242500	340801	.282			
22	4.67		4.67	1.75	146	39.28	185.28	41.5	42	9.30	7000	4.67	326900	76891	.235			
23					202	40.16	242.16		48	8.14	8200		382940	100496	.262			
24	4.67		4.67	2.00	146	39.28	185.28	41.5	39	10.02	7430	4.67	346981	76891	.221			
25					202	40.16	242.16		45	8.70	8450		394615	100496	.253			
26					230	40.60	270.60		47	8.32	9000		420300	112299	.266			
27					257	41.06	298.06		51	7.66	9850		459995	125705	.268	.268	7.66	
28	4.67		4.67	2.25	257	41.06	298.06	41.5	48	8.14	9900	4.67	462330	123705	.266			
29					285	41.50	326.50		50	7.82	10425		486847	135497	.277			
30					299	41.72	340.72		52	7.51	10775		503192	141398	.279			
31					313	41.94	354.94		54	7.23	11075		517102	147300	.283	.283	7.23	
32					341	42.38	383.38		57	6.85	12650		590755	159102	.267			
33	2.00		2.00	2.50	76	38.18	114.18	41.5	64	6.10	9700	2.00	194000	47373	.247			
34					90	38.38	128.38		69	5.66	10600		212000	53277	.253			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table T.—Part I.

Chute No. 7.—*Undershot. Wheel removed from Breast. Bottom of Gate at bottom of Wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	20.75		20.75	1.00	669	47.58	716.58	41.5	26	15.00	4925	20.75	1021937	297379	.290			
2					725	48.45	773.45		27	14.46	5325		1104937	320981	.290			
3					772	49.21	821.21		28	13.96	5560		1153700	340801	.296	.296	13.96	
4					800	49.65	849.65		29	13.46	5760		1195200	352604	.293			
5					828	50.09	878.09		31	12.60	6000		1245000	364407	.292			
6					875	50.84	925.84		34	11.50	6550		1359125	384223	.282			
7	20.75		20.75	1.25	875	50.84	925.84	41.5	25	15.64	6155	20.75	1277062	384223	.300	.300	15.64	
8					978	52.47	1030.47		29	13.46	7025		1457687	427644	.291			
9					1081	54.10	1135.10		33	11.84	7925		1644437	471065	.287			
10	4.67		4.67	1.75	202	40.16	242.16	41.5	48	8.14	8075	4.67	377100	100496	.266			
11					230	40.60	270.60		51	7.66	8800		410960	112299	.276	.276	7.66	
12					244	40.82	284.82		58	6.73	9775		456492	117200	.258			
13	4.67		4.67	2.50	285	41.50	326.50	41.5	47	8.32	10800	4.67	504360	135497	.266			
14					313	41.94	354.94		50	7.82	11500		537050	147300	.274			
15					341	42.38	383.38		51	7.66	11775		549892	159102	.290			
16					360	42.69	402.69		54	7.23	12200		569240	167116	.293			
17					374	42.91	416.91		56	6.98	12800		597760	183017	.305	.305	6.98	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE T.—PART II.

CHUTE No. 7.—*Undershot. Wheel removed from Breast. Bottom of Gate at bottom of Wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Apature.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
18	3.00		3.00	2.00	76	38.18	114.18	41.5	48	8.14	7300	3.00	219000	47373	.216			
19					146	39.28	185.28		62	6.30	9300		279000	76891	.275			
20					160	39.50	199.50		65	6.01	9920		297600	82792	.277	.277	6.01	
21					188	39.90	227.90		81	4.82	12000		360000	94578	.262			
22	3.00		3.00	2.50	146	39.28	185.28	41.5	55	7.10	10375	3.00	311250	76891	.247			
23					160	39.50	199.50		56	6.98	10600		318000	82792	.264			
24					188	39.90	227.90		60	6.51	11575		347250	94578	.272	.272	6.51	
25					202	40.16	242.16		65	6.01	12425		372750	100596	.269			
26	2.00		2.00	2.00	76	38.18	114.18	41.5	69	5.66	8400	2.00	168000	47373	.281			
27					79	38.23	117.23		72	5.43	8710		174200	48650	.279			
28	1.00		1.00	1.50	20	37.30	57.30	41.5	131	2.98	10625	1.00	106250	23779	.232			
29			1.00	1.75	20	37.30	57.30	41.5	105	3.72	10110	1.00	101110	23779	.241			
30			1.00	2.00	20	37.30	57.30	41.5	91	4.29	10400	1.00	104000	23779	.238			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

FRANKLIN INSTITUTE.

Minutes of the Board of Managers.

A MEETING of the Board of Managers of the Franklin Institute, was held at the Hall of the Institute, January 26, 1832.

JAMES RONALDSON, President, in the chair.

So much of the minutes of the Institute as related to the election of this Board, was read by the Actuary, when, on motion, the Board went into an election for a chairman for the ensuing year. Messrs. Thomas Fletcher and Isaac B. Garrigues, were appointed tellers, who received the votes of the members, and reported the result to the president, who declared WM. H. KEATING, Esq. duly elected chairman.

Mr. Keating made an appropriate address, and took his seat as presiding officer, when the Board continued the election for Curators for the ensuing year; the same tellers were continued, the following gentlemen were duly elected curators—SAMUEL J. ROBBINS, ISAAC HAYS, M. D.

The regulations adopted by the former Board were read, and after some amendments were adopted for the government of this Board.

On motion, the committees appointed by the late Board to try experiments on water wheels, and to inquire into the cause of the explosions of the boilers of steam engines, were continued.

A stated meeting of the Board of Managers was held at the Hall of the Institute, February 9, 1832.

WM. H. KEATING, presiding.

The minutes of the last meeting were read and approved.

The chairman nominated the several standing committees agreeably to the regulations, when, on motion, the names of Messrs. Christian Gobrecht and W. R. Johnson, were added to the committee on inventions—Mr. Wm. H. Keating to the committee on premiums and exhibitions; and Mr. Jacob Pierce to the committee on minerals. The committees were then constituted as follows, viz.

On Premiums and Exhibitions.

S. J. Robbins,
Frederick Fraley,
M. W. Baldwin,
Joshua G. Harker,
Alexander Ferguson,
J. Henry Bulkley,
Isaiah Lukens,
Wm. Wetherill,
Wm. H. Keating.

On Inventions.

Samuel V. Merrick,
Benjamin Reeves,
Alexander Dallas Bache,
James Ronaldson,
Isaiah Lukens,
M. W. Baldwin,
Rufus Tyler,
John Agnew,
Christian Gobrecht,
W. R. Johnson.

On the Library.

M. D. Lewis,
Isaac Hays,
Alexander Ferguson,
Wm. B. Reed,
John B. Trevor.

On Publications.

Isaac Hays,
Samuel V. Merrick,
Alexander Dallas Bache,
M. W. Baldwin,
Charles Toppan.

On Instruction.

Alexander Dallas Bache,
Charles H. White,
Frederick Fraley,
Samuel J. Robbins,
John Weigand.

On the Cabinet of Minerals.

Isaiah Lukens,
William Wetherill,
Abraham Miller,
Thomas Scattergood,
George W. Tryon,
Jacob Pierce.

On the Cabinet of Models.

Frederick Fraley,
Rufus Tyler,
John Agnew,
Isaac B. Garrigues,
Charles H. White.

Managers of the Sinking Fund.

Samuel V. Merrick,
John B. Trevor,
John Struthers.

Auditors.

Mordecai D. Lewis,
Isaac B. Garrigues.

The candidates proposed at the last meeting were duly elected members of the Institute.

Several candidates for membership were proposed, and laid over until the next meeting, agreeably to the by-laws.

Extract from minutes.

WILLIAM H. KEATING, *Chairman.*

WILLIAM HAMILTON, *Actuary.*

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN SEPTEMBER, 1831.

With Remarks and Exemplifications, by the Editor.

1. For an improvement in the *Marine Rail-way,* for the purpose of hauling vessels out of the water; John G. Colley, Shipwright, Norfolk, Virginia, September 1.

This rail-way is the well known Moreton's rail-way, which forms an inclined plane, upon which vessels are to be hauled up. The improvement consists in having a tongue project up from the centre of the iron plate with which the rails are faced, and in having grooves

in the middle of the rollers into which the tongues enter, and serve as guides. The cradle upon which the vessel is received has similar plates and tongues on its lower side, which work into the grooves on the upper sides of the said rollers.

The foregoing is the whole substance of the specification; no claim is made, but it is plain that the tongued plates, and grooved rollers, are considered as constituting the invention.

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2. For an improvement in the *Machine for Shelling and Cleaning Corn;* Jesse Reed, Marshfield, Plymouth county, Massachusetts, September 1.

A cylinder of wood, about ten inches in length, and six in diameter, is to be set with spikes. This cylinder has a pinion on one of its axles into which meshes a cog wheel, turned by a crank. The ears of corn are borne up laterally against the cylinder by which they are shelled; wires are so placed in the cheek which bears against the corn as to give it a progressive motion. The bottom is formed of wire grating, which allows the chaff, but not the corn, to pass through; this latter, with the cob, falls down a trough at the end of the machine.

The claims are to the horizontal cylinder; the pitch of the bed piece on which the ear rests; the grates for conducting and cleaning the corn; the wires on the arm which regulate the ear; and the enclosing the machine so as to prevent the scattering of the corn.

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3. For an improvement in the *Scraper for the removal of earth;* denominated the "excavating scraper," Dudley Marvin, Canandaigua, Ontario county, New York, September 2.

(See specification.)

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4. For an *Apparatus for excavating and removing Earth,* denominated the "inclined plane excavator;" Dudley Marvin, Canandaigua, Ontario county, New York, September 2.

(See specification.)

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5. For an instrument for determining the points in *Marking and Cutting Garments,* called the "American System;" John Pudney, Waterford, Saratoga county, New York, September 3.

Mr. Pudney's AMERICAN SYSTEM consists of a square like that of a carpenter, formed of wood or metal, one of the arms being about two feet in length, and the other about six inches. A segment of a circle unites the long and short arms, the angle of the square being its centre; a tongue, or secondary arm, works upon a joint at this centre, and opens like a rule. There are divisions, with letters and figures on the circular segment, and others on the arms, which serve as a scale to mark the points for cutting garments.

The claim is to the before described instrument.

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6. For an improved *Scraper and Harrow,* to be used in the

cultivation of Cotton; William P. Sample, Bedford county, Tennessee, September 3.

The frame work of this instrument resembles that of the well known triangular harrow, or cultivator. The patentee states that other scrapers have been made which nearly resemble his, but that their frame work was so constructed as to cause the horse employed to draw them, to trample upon the cotton, whilst by his construction, the animal is removed a foot from the rows. Scrapers, in the form of a V, are fixed upon helves so as to work upon each side of the row of cotton; these scrapers are so formed as to cut the surface, and cover low grass and weeds with earth. It is said that in consequence two scrapers being fixed on the same instrument, it executes double the work of any other. The patentee, however, relies principally on the form of the wooden part, as sustaining his claim to novelty.

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7. For a *Machine for digging Ditches and excavating Canals;* William Graham, New Orleans, Louisiana, September 5.

A wheel, made somewhat like the bucket wheel of a water mill, is to perform the excavating, for which purpose the buckets, or arms, are to have their edges armed with steel cutters.

This excavating machine is to be driven by horse or steam power, through the medium of a crank, and a train of wheel work. A frame is to be made of sufficient strength to support the whole apparatus, which is to be fixed upon wheels, and moved forward by the same power that drives the excavating wheel, which wheel is fixed upon a shaft supported by the carriage frame. A steam engine may be employed to drive a pinion on a crank shaft, which, taking into a spur wheel on the shaft of the excavator, will give it the required motion. To cause the carriage to advance as the excavation proceeds, two of the carriage wheels are to be turned by means of endless screws, driven by bevel gear from the shaft of the excavating wheel.

The earth removed by the cutters, is to be carried up by the arms or buckets, until it arrives at its greatest elevation, but when it has passed a line perpendicular to the centre of the wheel's motion, it is to be forcibly thrown off on to a sloping roof fixed for that purpose. In beginning to work with it, an excavation must be made in the ground to receive the operating wheel.

The patentee says that with an engine of eight horse power, this machine will perform the labour of three hundred hands.

If the inventor has actually tried his machine and fully tested its utility, his experience is worth infinitely more than all our speculations. Should it have answered its intention on the Planquemine canal, or on other ground in the vicinity of New Orleans, where there are neither stones or roots, that is all which can be expected from it, and would suffice to establish its character for use in similar situations. In the absence of all evidence upon the subject, we, however, are apprehensive that the throwing off the dirt at the proper time, and

the causing it to arrive upon the sloping roof, down which it is to fall, will be attended by some difficulty.

8. For an improvement in the mode of *Manufacturing coarse Salt from salt water;* Aaron Barnes, Deerfield, Oneida county, New York, September 7.

A boiler of iron or copper, which is to be the frustrum of a cone, is to be fixed horizontally. This boiler may be twenty-two feet in length, three feet in diameter at the larger, and two feet six inches at the smaller end. It is to be surrounded by a flue, a furnace being placed in front of it, that is, at the smaller end; the heat from the furnace is carried under the boiler, and returned back above it to a chimney at the front. The boiler is to be supplied with salt water through a tube, which reaches nearly to its bottom, conducting the cold water into the most heated part at the front. The back end of the boiler opens into a *boiling vat*, which may be a wooden vessel, twelve feet square, and five deep. This vat is to be closely covered to prevent the escape of steam. A *settling vat* forty feet long, twelve wide, and two deep, is placed below the boiling vat, so that the concentrated salt water may be drawn off from the latter into the former. A salting, or *crystallizing vat*, 140 feet long, twelve wide, and one deep, may receive the brine from the settling vat.

Tubes from the boiling vat convey off all the steam generated and carry it under the settling and salting vats. These tubes, widened out, make a part of the bottoms of the vats, and thus convey the heat of the steam to the brine. When additional heat is required other similar tubes from independent boilers may be employed to supply it.

By this arrangement, coarse salt, it is said, is rapidly formed in the salting vat, and both labour and fuel saved.

The claim is to the arrangement of the utensils, and their application to the purposes, and in the manner, specified.

9. For an improvement in the *Material, or manufacture, of the Surgical Instrument called the Pessary;* Joseph Warrington and William Scattergood, Northern Liberties, Philadelphia county, Pennsylvania, September 5.

The material to be employed is glass, which from its power of resisting corrosion, is not acted upon by those secretions to which the instrument is subjected when in use. The pessary is to be made in all the variety of forms which may be required, and is in general to be blown hollow, to insure the requisite lightness.

10. For an improvement in the *Machine for Breaking Hemp;* William Stone, jr., Williamson county, Tennessee, September 8.

This is the old fashioned Dutch break; but the patentee says that he makes an additional set of teeth across the jaws of the break. The upper jaw is to be raised by cams, or lifters, upon a shaft, and the teeth, as well as the whole machine, we are told, may be made larger or smaller.

The patentee claims the mode of applying the power, as well as the additional teeth. We do not perceive what there is new in the mode of applying the power; the additional teeth, may, possibly, add something to its utility.

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11. For *Making Rope and Cordage of all kinds, by machinery;* William Stone, jr. Williamson county, Tennessee, September 8.

By means of the machinery described in the specification, the hemp, or other material, is to be converted into laid rope, by a continued operation. We shall not attempt to describe the apparatus employed, as this would be of little avail without drawings; nor do we think it necessary, as several patents have been obtained in this country for machines operating upon the same principle, and similar machines are in use in England. The principal object proposed is the twisting and laying at one operation, and the patentee says that this may be effected by means of his machinery, not only on small cordage, but also on the largest ships' cables. That he can thus manufacture cordage and ropes of a moderate size, we are well aware; but large ships' cables would prove to be untractable affairs to twist about and whirl round in the manner required.

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12. For a *Washing Machine;* Wilson Gregory, city of Richmond, Virginia, September 9.

This is a rectangular box, with gudgeons on two of its ends, and a crank by which it may be made to revolve. On one side is an opening, and a closely fitting door, and at each of the four longitudinal angles within the box are fixed four rollers, which give its interior an octagonal form.

The claim is to the foregoing machine, and particularly to the rollers, to prevent the clothes being injured by friction.

Will not some ingenious *inventor* add a roller at each angle, and then take out a patent for his improvement?

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13. For an improvement in the *Bee Hive and the art of managing Bees;* Eben Britton, Littlefalls, Herkimer county, New York, September 9.

We do not think it necessary to enter into a detailed description of the construction of this hive, or of the particular manner of using it. It consists generally of three boxes, which may be placed one upon the other. Each of these is divided into two compartments, and they are furnished with slides which open and close apertures leading from one box, or compartment, to another, the object of which is so to manage the bees that the contents of the upper box, and of smaller boxes, which are occasionally applied, may be obtained without disturbing the bees.

The patentee appears to think the whole arrangement new, as he claims "the entire art of managing bees as herein described; together with the bee hive and its component parts, as constructed; ex-

cepting only the small boxes placed at the top of the first or uppermost box, the four cross sticks in the main part of each box, and the mouth or orifice in front of the same."

Boxes have been repeatedly placed upon each other, and sliding pieces have been applied to open and close the communication between the various compartments of hives so constructed, and, of course, a management of the bees very similar to that of the present patentee has been adopted. In the last number at p. 133, we had occasion to notice an arrangement of hives very similar to the present in its general principle.

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14. For an improvement in *House, Ship, and Camp Furniture;* Edward Clibborn, Cincinnati, Hamilton county, Ohio, September 12.

An extended description is given of the various applications of this improvement to bedsteads, cots, lounges, easy chairs, and various similar articles, and this is accompanied by forty-four drawings, or sketches, intended to illustrate these applications. The object proposed is to obtain greater elasticity than ordinary in the bottoms of such furniture. For this purpose oval frames are to be made of hickory, ash, whalebone, iron, steel, or any other elastic substance. These frames form elastic hoops which may be joined together by rivets, bands, hinges, or otherwise. Over these frames, ticking, netting, or other material is to be stretched and secured to the hoop. The threads, if cloth is used, are to extend obliquely, or biasing, and it is not to be strained so as to destroy the elastic action of the hoop or frame.

Cots, or bedsteads for invalids, may have hinges placed upon the upper or lower sides of the oval frame, to allow the bottoms to be elevated or depressed in the manner of such as have been used in hospitals and elsewhere.

The patentee calls the furniture, so made, *atmospheric furniture*, because persons reclining on bottoms of this description may be exposed to the action of air on every side.

There is no particular claim made, but the general nature of the thing intended to be patented is made sufficiently obvious.

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15. For an improvement in the mode of *Raising Ships, or other Vessels, Canal or Steam-boats, Sloops, Schooners, &c.*, weighing anchors, discharging cargoes, hoisting goods in stores, raising and removing buildings, and all kinds of heavy burthens, and used as a compressing machine, known and distinguished by the name of the "Elevating Power Engine and Compressing machine;" Benjamin Bruff, Rochester, Monroe county, New York, September 13.

In addition to the purposes named in the above title, to which, it is said, this machine may be applied, there is afterwards added the raising of mineral coal, and *weights to propel boats or mills.*

The machine consists of three or more levers of the first kind; these

levers are to be fixed in a frame, side by side, as they are to operate simultaneously. When used for raising ships or other vessels, the extreme ends of the levers are to be passed under the vessel, or they may pass over the deck; in which case, iron chains or braces are to pass from them round the keel. When the vessel is thus secured, a double windlass, situated below the longer ends of the levers, is used to draw them down, and raise the vessel.

The levers, we are told, may be about forty feet long, and, as shown in the drawing, the fulcrum is about one-fourth of that length from the boat; to raise a vessel five feet, the other end of the lever must, therefore, be depressed fifteen. What then must be the length of a lever to raise a ship? It is really strange that any one should expect to accomplish such a purpose by means so totally inadequate; but the climax is capped by the proposition to raise weights to propel boats or mills; the absurdity of the original design is scarcely to be noticed alongside of this new intention.

Another gentleman of Rochester, Mr. William W. Smith, obtained a patent for a machine altogether similar, excepting that the levers were to be drawn down by screws, instead of by a windlass and rope; the specification of this patent may be found at p. 301, vol. v. with some remarks of ours respecting it.

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16. For an improvement in the mode of manufacturing *Steel Forks*, called "Goodyear's Steel Forks;" Charles Goodyear, city of Philadelphia, September 7.

The patentee proposes to make steel pronged forks, with iron shanks, without splitting the steel in forming the prongs. Steel is to be taken of proper size for forming the prongs; and for a two pronged fork this is to be laid upon an iron bar, about two inches from its ends, the steel at right angles with the iron, and extending each way far enough to form a prong. The end of the iron bar is then to be bent over, and cut off even with the short piece. After forming the prongs by pointing and bending, the iron is to be welded and drawn out to form the shank.

When there are to be three or four prongs, the process is to be so managed as to admit of their formation on the same principle.

The fork, when completed, is to be dipped in melted tin, until it is coated with that metal.

The claim is to the manner of putting the materials together, without splitting the steel bars, and to the tinning of the forks.

The blacksmith must judge respecting the novelty in the proposed manner of making forks, as upon this depends the validity of the claim. For ourselves, we should have supposed that any intelligent workman who happened to have a steel rod the right size for prongs, would readily resort to such a mode of using it, without exhibiting any more of invention than is daily called for in the pursuit of his business.

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17. For an *Anthracite Cooking Stove;* Walter Bryent, Boston, Massachusetts, September 13.

The stove is to be made of cast iron, and the anthracite is to be burnt in a grate of the ordinary construction, but besides the front bars, the grate is also to have perpendicular bars at the back to admit of a draft through the fire to, and round, an oven, which stands behind the grate. Dampers are to be provided to regulate the draft; a boiler is to be placed directly above the fire, and a larger one above the oven; tubes from these boilers are to conduct the steam into another tube leading directly under the furnace, that it may pass into the fire.

The parts considered as new are not designated, no claim being made; there is a drawing, but it is without written references.

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18. For an improvement in the *Water Wheel, and the application of Water thereto;* Joel Eastman, Bath, Grafton county, New Hampshire, September 28.

(See specification.)

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19. For *Manufacturing Shovels, or Scoops, from sheet iron, copper, zinc, or any other metal;* Mordecai Bull, Greenwich, Washington county, New York, September 28.

A cast iron bed piece, of the proper form, with a follower to fit into it, and which is to be forced down by means of a lever, constitute the apparatus used. The sheet metal is to be forced between the follower and bed, into the required shape.

This kind of machinery is too well known to be the subject of a patent, it must therefore be intended to claim the applying it to the manufacturing of the particular articles in question, a claim of very doubtful validity.

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20. For a *Thrashing Machine;* Thomas Carpenter, Elmira, Tioga county, New York, September 28.

Instead of the cylinder usually employed, a wheel of pine boards is to be made of about five feet and a half in diameter. This is to be strengthened on one side by a rim of oak; on the opposite side are to be fixed strips of wood, armed with iron, which constitute the beaters, of which there may be sixteen or eighteen, radiating like the spokes of a wheel. The wheel thus prepared is to be fixed vertically in a frame, like a grindstone, and between it and a facing fixed to the frame the thrashing is to be effected. The facing, which answers the purpose of the ordinary segment, is to be made into ridges, and to have strips of iron to strengthen and defend it. A band and whirl may be used to give motion to the wheel.

The patentee says, "What I claim as my improvement in the thrashing machine is, that a wheel of this size and form requires only about five hundred revolutions in a minute, and will make as good work and as expeditious as the cylinder machines that require from fourteen to sixteen hundred." This certainly is not a very felicitous manner of presenting the claim.

21. For a *Thrashing Machine*; Ezra Wickwire, Alexander, Gennessee county, New York, September 28.

The cylinder of this machine is the only part claimed, and upon what ground it would be no easy task to tell; there are no precise directions given respecting it, but, on the contrary, a general latitude of construction is proposed, embracing several old and well known plans. The cylinder may be of wood or of iron, either cast or wrought, the beaters may run either straight or diagonally, and their number may vary as you please. The concave may be placed either above or below, and may be made like the cylinder, or as you like it.

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22. For a *Shingle Machine;* Cheney Reed, Worcester, Worcester county, Massachusetts, September 28.

A cast iron wheel is to be made to revolve horizontally in a suitable frame; a knife, or shave, which is in segments, forms a circular cutter on the under side of this wheel. There are to be two circular platforms which also revolve upon vertical shafts underneath the cutter wheel, one on each side of its shaft, their peripheries approaching each other as nearly as the shaft of the cutter wheel will allow. Upon the upper surfaces of these platforms are pieces which serve to gripe the shingles to be shaved; the bed upon which the split or sawed shingle lies has a sufficient inclination to give to it a thick and thin end. The dressing on one side is effected on one of the platforms, and the shingle is then removed to the other platform, which finishes the other face, each of these platforms carrying the shingle under the revolving cutter. From the upper side of the cutter wheel project out four knives, or clearers, which serve to cut and remove the shaving, as this, from its width, might otherwise obstruct or choke the machine.

The claim is to the circular rotary shave, and the circular rotary carriages, or platforms.

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23. For a *Spring Door Catch;* James Buck, Bucksport, Hancock county, Maine, September 28.

This is a very simple contrivance, consisting of a bolt, spring, and knob, or knobs. The bolt is to be let into the edge of the door by boring a hole of sufficient depth. A straight spring, let into the edge of the door under the bolt, and covered by a plate, forces the catch forward. Knobs, or handles, like those upon the spring bolt of a lock, turn in the usual manner, a projection, or pallet, upon the shank serving to push the catch back.

There is no claim made, and no further room for one than is furnished by a trifling variation of form from such bolts and catches as have been in common use.

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24. For a *Churn;* James Van Auken 2nd, Knox, Albany county, New York, September 28.

An upright churn has within it two vertical shafts which are made

to revolve and carry dashers; there is a cog wheel taking into pinions on the top of the two vertical shafts, and by turning a crank these are set in motion.

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25. For a *Suction and Lifting Pump;* Elisha Tolles, Litchfield, Litchfield county, Connecticut, September 28.

This patent is taken for the particular arrangement of the different parts of this pump without a claim to any thing new in its principle. The tubes, chamber, and other parts, are to be of metal. The chamber is to be low down in the well, and the piston rod is to descend through a tube which operates as an air vessel, the rod working through a stuffing box at the top of it. A rising main, or delivery pipe, extends up, entering the side of the chamber at its upper part. The piston is to be of metal, with a leather stuffing. The mode of making it is particularly described, but we do not perceive in it any thing rendering it superior to some others already in use.

One object in placing the chamber low down is to avoid danger from frost; the water, however, in the rising main is as much exposed as usual.

Although called a suction and lifting pump, it is, in fact, a forcing pump.

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26. For an improvement on the mode of *Applying Rollers for the reduction of friction in axles*, &c., as first patented January 27, 1830; Isaac Cooper, Baltimore, Maryland, September 28.

This is a modification of Garnett's friction rollers. Upon the end of the axle of a rail-road car, a plain metallic ring is to be placed. Friction rollers which revolve on their axes surround this ring, exactly as they surround a gudgeon on Garnett's plan, as this ring is in reality nothing more than an enlargement of the gudgeons. The outer peripheries of these rollers press against a semicircular metallic arch upon the frame of the car. The claim is to this arrangement.

This, in principle, is essentially the same as Garnett's rollers, although presented under an arrangement somewhat different from his, but not, as we perceive, affording any advantage over the old form.

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27. For an improvement in the *Application of the Power of Wind to Mills*, Factories, Boats, or Vessels, Pumps, and all kinds of Machinery; John Y. Van Tuyl, Rahway, Essex county, New Jersey, September 28.

This wind wheel is to revolve horizontally, being sustained and balanced on a shaft passing up through its centre into a cavity on the upper side of it. Its periphery is surrounded with buckets something like those of a water wheel, but pointing, as radii, to the centre. The wind is to be made to act upon the buckets by means of what are called funnels, which are to direct it upon them obliquely. To form these funnels two rims are made like the rims of a water wheel; their interior diameters being such as to receive the top and bottom board of the wind wheel, and allow it to

revolve within them. Pieces, like floats or buckets, are to be placed between these rims, the same in width and number as those in the wind wheel; they are not, however, so arranged as to point to the centre, but stand nearly at right angles to the buckets of the wind wheel. The outer rim thus made forms the funnels through which the wind is to blow upon the wind wheel; a certain number of the funnels receiving and directing it on to the floats, whatever may be its direction.

There are to be doors to the openings of the funnels, in order to close any number of them when the wind is too powerful. The claim is to the improved manner of applying wind as described.

The specification is very far from being clear, and the drawing, although well executed, is without written references, and does not represent some of the parts described; we think, however, that we have not mistaken the views of the patentee, although we are very far from entertaining the same hopes upon the subject which have been his prompters; we anticipate but little advantage from the use of his invention. The proposition of applying the said wind wheel to boats, and other vessels, is most absurd, as all the power which goes to move the wheel will be expended without producing any action upon the boat. Should the wind be ahead, the boat will go astern with a little less rapidity than it would were the wheel locked fast; and should the wind be fair, the greatest advantage will be taken of the wheel by preventing its revolution altogether, and allowing it to act merely as a sail, although it will be one of a very inferior kind.

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28. For a mode of *Constructing Mill Stones*, for grinding grain, hulling clover seed, &c.; Benjamin Myers, Chambersburg, Franklin county, Pennsylvania, September 28.

The lower stone, which is about two feet in diameter at the bottom, is to be the runner; its shape is conical, the sides forming an angle of about fifty-five degrees, until they are about nine inches in width, when they pass to an apex at an angle of twenty degrees. The bed stone, which is supported upon a frame above the runner, is hollowed to receive it, and has an eye through its centre; this stone may be six inches more in diameter than the runner, and about fourteen inches thick.

The claim is to the form of the bed stone and runner.

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29. For an improved *Chair, or Hospital Bedstead;* Williams Woolley, city of New York, September 28.

A narrow bedstead is to be made in the form of the four post bedstead, but so constructed as to be capable of being readily converted into an easy chair. The bottom is to be divided into three parts, the centre one of which is to be stationary, but the upper part is capable of being raised by a crank and pulleys so as to form the back of the chair, whilst the lower, or foot part, is capable of being let down to

form the front of the chair, as it may then stand at right angles with the stationary part, which now forms the seat.

There are contrivances which answer as arms to the chair, and some other appendages not requiring particular notice. There is no claim made to any of the parts described, which appears to us to be a serious omission, as bedsteads, or couches, have been constructed which are capable of being raised and lowered much in the manner of that before us, and we ought, therefore, to have been informed what is new in it.

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30. For an Economical *Baker and Roaster;* Philip Wilcox, Springfield, Hampden county, Massachusetts, September 28.

The action of this apparatus, and indeed its whole construction, so nearly resembles the ordinary tin kitchen, as to need but little description. The upper part is to be of sheet tin, arched, to reflect the heat. Moveable sheets of tin are to be placed below the meat, sloping from the front towards the back at an angle of forty-five degrees.

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31. For *Self-guiding and accommodating Cars for Railways;* Levin Clark, Baltimore, Maryland, September 28.

To this car there are to be six wheels; the two fore wheels are attached to a frame separate from the main frame of the car, and capable of varying its direction so as to allow the wheels to deviate and adapt themselves to any curve. From this frame a connecting bar leads back to the axle of the next pair of wheels, and the apparatus is so arranged as to change the direction of these so far as to cause the three wheels on either side to run upon the required curve. The particular arrangement by which it is proposed to effect this object cannot be described without drawings. The locomotive engine is to be provided with two cylinders, each of which is to operate upon one of the remaining pair of wheels through the medium of distinct cranks. It is intended by this means to give different velocities to these wheels, corresponding to the curves over which they are to pass. How this is to be effected with the necessary precision we are not informed, and cannot tell. The steam engine is a very manageable instrument, but, we apprehend, not so perfectly controllable as this proposition would indicate.

The claim is to "the principle of *working two cylinders with one head of steam,* and the principle embraced in the *coupling or gearing,* by which the wheels will arrange themselves on the different radii of the tracks."

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32. For the application of *Horse and other Animal Power, to move Machinery;* George Page, Keene, Cheshire county, New Hampshire, September 28.

There may be something very new in this horse power machine, but we have not yet found it out. An endless band is to pass over two cylinders placed at a proper distance from each other to allow the upper side of the band to form an inclined plane upon which a

horse may walk. The band may be made of stout leather, and be covered with slats of wood bolted to it. Proper friction wheels sustain the slats, or floor, and run upon iron ways.

The claim is to the "application of horse power to move machinery for sawing wood, propelling boats, &c. &c. by an inclined band operating in the manner above described.

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33. For a *Grist Mill;* Ezra Brees, Kingston, Luzerne county, Pennsylvania, September 28.

The claims made by the patentee of this portable grist mill, are to the running of small stones about 400 revolutions in a minute, without pressure or artificial weight; the mode of preventing their heating; the manner in which the spindle, balance rine, and driver are made, &c. &c.

The particulars claimed are not clearly described, or plainly shown in the drawing; enough, however, is seen to prove that some of the points supposed to be new, are not entitled to this character.

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34. For *Machinery for Cutting and Punching Iron and Steel;* Jedediah Richards, Elbridge, Onondaga county, New York, September 28.

A bar of iron is bent round like spring shears, and one side of this bar is to be fastened to a bed piece of stout wood. The die against which the cutter or punch acts is fixed upon the lower side of the bar, near its end, and the cutter, or punch, is fastened to the other end above the die. A lever, with a long arm, is secured by straps, or cheeks, of iron, so as to act upon the two ends of the bent bar, and this lever, when depressed, forces the punch or cutter down by the power of its short arm. The bow of the bent bar serves as a spring to raise the punch, or cutter, when the power is taken off.

There is no claim made, nor do we perceive any thing upon which one could be fairly founded, excepting it be the mere bend in the bar acting as a spring; this arrangement is probably new.

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35. For an improvement in the *Re-acting Steam Engine;* Ambrose Foster, Brutus, Cayuga county, and William Avery, Salina, Onondaga county, New York, September 28.

In this engine, the steam is to issue from the opposite sides of revolving arms, as the water does from the rotary trunk of Barker's mill. The oldest steam engine known, that of Hero of Greece, acted upon this same principle; and numerous others have been constructed in modern times, which were to operate in this way. The present patentees do not pretend to be the inventors of this kind of engine, but to have devised such improvements as they believe will render it more efficient than it has hitherto been.

It is intended that the arms shall revolve within a drum or case; from this a tube is to conduct off the steam, a portion of which, when condensed, will serve, in part, to supply the boiler. The improvement relied on by the patentees consists in making the revolving tubes flat, instead of round, that they may be subjected to but

little resistance from the atmosphere. They say that "in an engine which we have in actual operation, the arms are each twenty inches in length. The width of the arms at the centre is about six inches, and at the ends about two inches and a half. In depth, or thickness, they are about one inch and a half near the centre, and about three-fourths near the end. The size of the holes through which the steam escapes, is about one-fourth by one-eighth. The holes are so perforated that the steam shall issue at right angles with the shaft."

"We find it to be a point of great importance to give such a form to the revolving arms as shall subject them to the least possible resistance from the air; we, therefore, instead of making them in the form of round tubes, which has been heretofore done, give to them the form which results from making each half of the arm a segment of a large circle; so that when the two halves are united, the edges of the tube present acute angles. The tubes, however, may be made elliptical, or oval, and the same end will be in a great measure attained. We use any number of such arms on the same shaft, as we may find best adapted to our purpose."

"We do not claim to be the inventors of the reacting steam engine, nor of the case, or drum, within which we intend the arms shall in general revolve; but what we claim as our invention is simply the giving the oblate or flat form to the revolving arms, so that in proportion to their capacity they shall experience much less resistance from the air than that to which they have been heretofore subjected, thereby obtaining a greatly increased power."

We have been induced to give more room to the notice of this engine than we should otherwise have done in consequence of the information contained in a letter recently received from one of the patentees, that it had been in continued use ever since the issuing of the patent, in a factory owned by him, and had fully justified all his anticipations.

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36. For an improvement in the *Apparatus for Distilling Spirituous Liquors;* Lemuel Wellman Wright, a citizen of the United States, now residing in London, England, September 28.

This apparatus consists principally of an alembic, a rectifying cistern, and a refrigeratory, each of them having something peculiar in its construction. In the body of the still there is to be a plate of copper which may be fifty feet long, and a foot wide, bent into a helical form, like the main spring of a watch, which is to be fixed upright on the bottom of the still, forming a spiral channel from its centre to its sides. The liquid to be distilled falls in a continued stream into the centre of this coil, and in its circuitous rout to the discharge cock, is to be deprived of all its alcohol. Instead of a spiral, the plate may be bent in a zigzag, or other, manner.

The wine, or wash cistern, is fixed above the rectifier, and the liquid passes from one to the other through a regulating cock, and falls upon a copper tray-like shelf, perforated with holes, and through

these it passes, in a fine spray, on to successive shelves, in a similar manner. The vapour from the still passes into this rectifier, and not only heats the wash, but subjects it to a steam distillation. The vapour which is thus formed escapes through a tube into the refrigerator, where it is condensed.

A self-regulating apparatus is employed to govern the admission of the wash, and the temperature of the rectifier; this regulator operates upon the principle described in Mr. Wright's patent for a "heat governor," of which we gave some account in the last number, p. 110.

The patentee states that he does not claim any of the known mechanical parts described by him, separately, but the combined and improved arrangement as set forth in his specification.

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37. For *Rendering Tin Plate more durable when used for various purposes, by Coating it with Lead;* Joseph M. Truman, city of Philadelphia, September 29.

(See specification.)

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38. For a *Machine for the Manufacture of Barrels*, Tubs, and other Cooper's ware; John Cole, of Belpree, Washington county, and Samuel Miller, of Athens, Athens county, Ohio, September 29.

This machine is intended to perform the various operations of shaving the staves and hoops, jointing the staves, turning and dowelling the heads, dressing the ends of barrels, cutting the croes, and facing the heading.

Any adequate power is to be applied to give motion to the machinery, through the intervention of cog wheels, drums, and other gearing. Three are to be fixed cutters through which the staves, or hoops, are to be forced by rollers. The jointing is to be effected by means of a knife, somewhat in the shape of a V, but with a much more obtruse angle; this knife is to be bent into the proper curve, and fixed across a frame working in cheeks like a saw frame; the stave is to be held down upon a suitable bed piece, and is then jointed by the descent of this knife, which must be equal in length to that of the stave. Such a knife, applied to the same purpose, formed a principal feature in a patent noticed by us a few months since. The part for shaping the heads, is a kind of lathe; and the dressing the ends of the barrel, and forming the croes, is also effected by revolving cutters.

The claim is to "the above described machine," which would be very well was it new in all its parts, but this is not the case.

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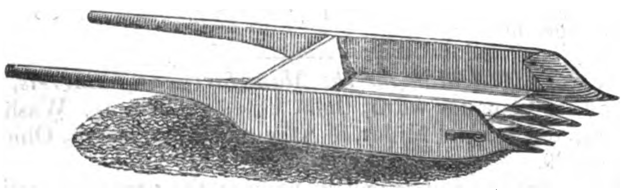
39. For an improvement in the *Bark Mill;* Charles H. Green and Richard Montgomery, Sangerfield, Oneida county, New York, September 30.

The general construction of this mill is that of the cast iron bark mills most commonly used. The improvements claimed are principally in the knives and ridges for breaking the bark; to these, such

a form is given as the patentee thinks will be most effectual in attaining the end proposed. Besides the particular formation of the parts mentioned, they also claim the "constructing the hopper and its several apartments and partitions entire, and of cast iron." By the hopper, in this case, is meant the exterior stationary box, or body of the machine, which has often been made "entire and of cast iron."

Specifications of American Patents.

Specification of a patent for an Excavating Scraper, being an improvement on the common scraper used for removing earth. Granted to Dudley Marvin, *of Canandaigua, Ontario county, New York, September 2,* 1831.



To all whom it may concern, be it known, that I, Dudley Marvin, have invented an improvement in the scraper used for the removal of earth, for various purposes, which I denominate the "excavating scraper," and that the following is a full and exact description of my said invention.

Instead of the straight, cutting edge of the scraper, I substitute any convenient number of cutting shares, or points, as shown in the accompanying drawing. These may be of cast or of wrought iron, or of iron and steel; I prefer cast iron, however, as being the most economical. The sides of my scraper are armed with plates, or cutters of metal, which are brought out to a point corresponding with the shares, or cutters, before named, and are so formed on their edges as to cut and clear the earth in the most perfect manner. The body of the scraper I in general make of wood, in the usual manner, but I give a greater height to the sides and back than is ordinarily given, as it will carry a much greater load than the common scraper. In order to strengthen the wood, and to provide firm attachments for the cutting points, and runners upon which the scraper will advance with facility, I generally pass bars of iron across, both at the front and rear, whilst other bars, serving as runners, pass not only under the sides of the scraper, but may also extend from front to rear, from each of the cutting shares, or points. To these bars the points are attached by screw bolts, the heads of which are countersunk, and the nuts received in excavations prepared for the purpose, and therefore offering no resistance to the sliding of the scraper.

With an instrument of this description, earth may be excavated and removed, without the necessity of first ploughing the ground, the animal by which it is drawn, walks, consequently, upon firm ground, and the whole business is greatly facilitated.

What I claim as my invention, and for which I ask a patent, is the employment of cutting shares, or points, with the sides to correspond with them, operating upon the principle herein set forth and specified.

DUDLEY MARVIN.

Specification of a patent for an Inclined Plane Excavator, for excavating and removing earth. Granted to DUDLEY MARVIN, *of Canandaigua Ontario, county, New York, September* 2, 1831.

To all whom it may concern, be it known, that I, Dudley Marvin, have invented a new apparatus for the purpose of excavating and removing earth, which I denominate the inclined plane excavator, and that the following is a full and exact description thereof, reference being had to the accompanying drawings which make a part of this specification.

The carriage part of the apparatus need not be particularly described, as it differs from such as are in use in those points only which adapt it to the machinery for excavating and loading, to be presently described. The main principles upon which the operation of this machine depends, is the employment of an excavator of a particular construction, to plough, or break up, the ground, and the raising and delivering it into the car when thus broken, by means of an inclined plane formed by an endless apron, or aprons, kept in motion by a revolving roller, or drum.

Fig. 1. D

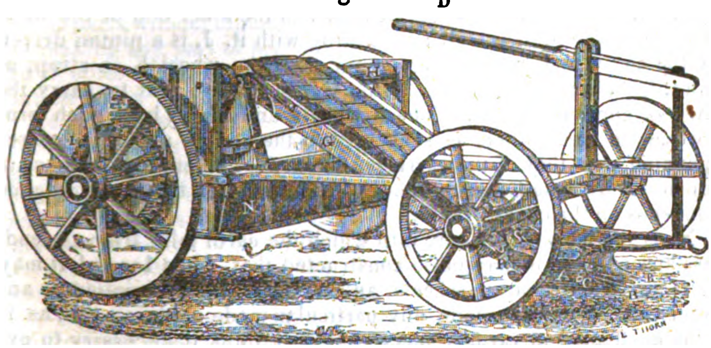
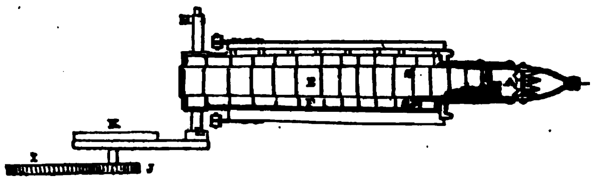


Fig. 1, in the drawings, is a perspective view of the machine; and Fig. 2 is a plan of the same, or rather of such parts as are required to be shown. A, is the excavator, or plough, for breaking up the ground; it is usually made of cast iron. The front or cutting edge of it is generally formed of pointed teeth, or shares, B, B, Figs. 1

and 2. The edges may, however, be made straight, or otherwise. Its under part, or sole, lies on the ground, like a shovel, and it has sides rising from it at right angles, or nearly so, as seen at C.

Fig. 2.



When the carriage is drawn forward, the plough, or excavator, is allowed to enter the ground to the required depth, this being regulated by the lever D, or by any suitable contrivance producing the same effect. The earth is delivered from the excavator, on to an endless apron, or endless aprons, at E, F. In the drawing, one of these aprons, E, is made narrow to receive the earth immediately from the excavator; this, at its lower end, passes over a roller appropriated to itself, immediately under the rear of the excavator as it rises from the sole, forming a commencement of the inclined plane. By this apron it is conducted up between the cheeks, or sides, of the excavator. The wider apron, F, when two are used, passes, at its lower end, round a roller extending across the inclined plane which it forms, and running in the cheeks G, G. At the upper end of the inclined plane, there is a drum, or cylinder, H, over which both the aprons pass, and from which they receive their motion.

The drum, or cylinder, above named, is made to revolve by a gearing connecting it with one of the hind wheels of the carriage. This may be effected in various ways, one of which is shown in the drawings. I, is an iron cog wheel attached to the inner end of the hub, or nave, of the hind wheel, and turning with it. J, is a pinion driven by the cog wheel, and having on its shaft the wheel K, a strap, or band, from which causes the drum, H, to revolve and to carry the endless aprons upon it. These wheels and whirls bear such proportions to each other, as shall give to the aprons a motion corresponding with that of the carriage, forward. The endless aprons are supported by a sufficient number of rollers under them, turning on gudgeons on the cheeks G, G.

N, is the body of the car, into which the earth falls from the endless aprons. This may be so constructed that, when loaded, it may be removed on separate wheels, and have its place supplied by another car. I do not claim any particular mode of doing this, as it may be effected in various ways; nor do I think it necessary to exhibit, or describe, those parts which are of minor importance, as every workman would vary these according to his own judgment or fancy.

The inclined plane is hinged to the carriage to allow it to rise and fall by the action of the lever D. In the strap of the hinge fastened to the cheeks of the inclined plane, I usually make slots in which the screw bolts are allowed to slide, for the purpose of tightening the aprons when requisite.

Fig. 3, is the inside of one of the cheeks; it has through it a slot, or mortise, there being a corresponding one on the opposite cheek. Into these slots, pass iron pins, projecting laterally from straps of iron attached firmly to the lower end of the wooden cheeks of the inclined plane. The play allowed by these slots, admits of a free motion of the plough to a certain extent, either up, or down, or longitudinally. It can, consequently, be depressed, according to the depth of hold which it is intended to take in the ground, or raised, until checked in a way to be presently described. The plough, by this mode of attachment, adapts itself also to its varying position in the draft.

Fig. 3.

Fig. 4.

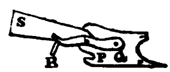


Fig. 4, is the outside of one of the cheeks. To this is attached a strap, or stop, P, by means of screw bolts Q, Q, or otherwise. When the plough is raised by means of the lever D, the end of the strap is brought into contact with the iron bar R, when a further action upon the lever will raise both the plough and the inclined plane.

S, Figs. 1 and 4, is a piece of sheet metal, playing freely around a bolt seen in Fig. 4; there being provision made between the strap P, and the cheek for that purpose. This, or rather these pieces of metal, serve to guide the earth as it passes from the elevated part, at the rear of the plough, until it arrives, or is delivered, on to the wide apron. Its rising and falling freely, prevents it from being affected by the varying inclinations of the plough, and allows its lower edge always to remain in contact, or nearly so, with the apron. The ends of these plates are seen at S, S, Fig. 2.

I have herein described the general construction of this machine, and have pointed out various particulars in the arrangement of some of its parts without intending, even where they are new, to claim them as making any part of my invention, as the same end may be attained in other ways, without altering the main principle upon which the action of my inclined plane excavator depends.

It will be seen that the above principle is applicable to the formation of trenches for the foundation of rail-roads, and also to the digging of ditches; the principal alteration necessary in these cases, being the constructing of the apparatus in such a way that the plough and inclined plane may descend to the required depth below the ground on which the wheels rest. I also contemplate the using it for the deepening of harbours, canals, and other waters; in which case, a boat, scow, or other suitable vessel, may be substituted for the wagon, or carriage, on land; the requisite power may be obtained from a steam engine, or other means, according to the nature of the labour to be performed.

In applying it to the digging of ditches, or trenches, the apparatus may be so modified that, instead of loading the earth into a cart, it may be thrown on either side of the trench, or ditch, when it is de-

sired to form a bank. Every competent machinist will at once perceive that practical modes of effecting these ends are easily devised, and that they may be modified in various ways, whilst the principle of elevating by the inclined plane, is still preserved.

What I claim as new, and for which I ask a patent, is the delivering the earth from the plough, or excavator, as above described, on to an endless revolving apron, or aprons, forming an inclined plane; and by such apron, or aprons, to carry the earth up so that it may be delivered into a car, or other convenient receptacle, or deposit it upon the ground upon the principle hereinbefore described; that is, by the use of the said revolving endless aprons.

Dudley Marvin.

Specification of a patent for an improvement in Water Wheels. Granted to Joel Eastman, *Bath, Grafton county, New Hampshire, September* 28, 1831.

(with a copperplate.)

To all whom it may concern, be it known, that I, Joel Eastman, have invented a new and useful improvement in the construction of water wheels, and the application of water thereto, and that the following is a correct description thereof.

To a vertical or horizontal shaft I attach two or more floats made of wood or iron, their proper proportions being about two feet long and one foot wide, making a wheel four feet in diameter and one foot long. This wheel is enclosed in a tight curve or case, fitting the wheel closely, and making part of a close trunk, or penstock, extending from the flume into the dead water at the bottom of the fall.

Should the necessary power and motion require it, two or more wheels may be attached to the same shaft, each wheel having its water conveyed to and from it separate from the others. For a vertical shaft there should be a penstock or close trunk, extending as high as the opening for the escape of the water from the upper wheel, and into the water at the bottom of the fall, into which penstock the water passes through an opening from each wheel, each opening being not less than five times as large as that by which the water is admitted into the wheels.

What I claim as my invention is a water wheel, or wheels, constructed in the manner above described, being enclosed in a case, the case being connected with, and forming part of, a tight penstock, or flume, extending the whole height of the fall, and the application of water to the wheel in the manner explained, however the same may be varied in practice.

Joel Eastman.

Explanation of the Drawings. (Plate 3.)

Fig. 1, is a bird's eye view of the wheel and its curve, or case, with the openings for the admission and discharge of the water; the top,

Fig. 1.

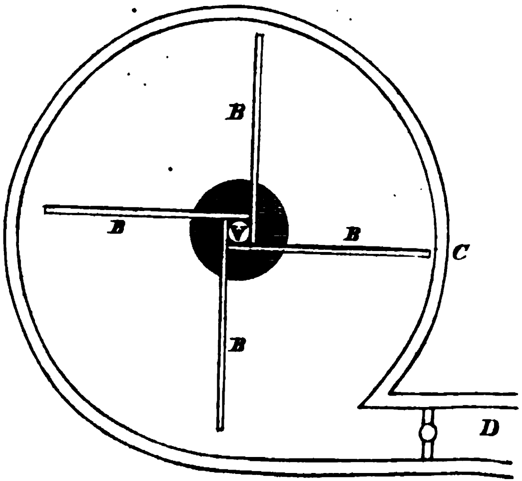
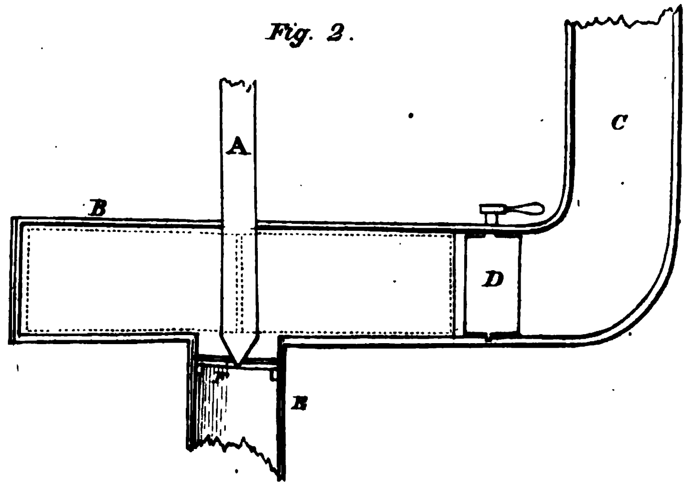


Fig. 2.



J. Eastman's Water-Wheel

or cover, of the case being removed for the purpose of showing its interior.

A, is the shaft to which the floats are attached.

B, B, the floats, which, in width, are equal to the depth of the case.

C, the edge of the curve, or case, the inside of which is not a circle, but is so formed that the ends of the floats approach more nearly to it as they pass round from the aperture for the admission of water, and almost touch it when they again arrive at it.

D, the aperture for the admission of water on to the wheel.

E, the opening through the bottom of the case into the descending trunk through which the water escapes.

F, the gate or valve to regulate the flow of water on the wheel.

Fig. 2, is a vertical section of the case, a part of the trunk, &c.

A, the shaft, passing through the cover, and giving motion to the machinery.

B, the case, or cover, the dotted lines within which show the floats.

C, the tube, or trunk, through which water is admitted on to the wheel.

D, the gate, or valve.

E, the descending trunk, extending to the bottom of the fall.

F, a bar across, serving as a step to the shaft.

Specification of a patent for rendering Tin Plate more durable when used for various purposes. Granted to Joseph M. Truman, *city of Philadelphia, September* 29, 1831.

To all whom it may concern, be it known, that I, Joseph M. Truman, of the city of Philadelphia, have invented a method of rendering tin plate more applicable to various uses than the ordinary manner of employing it with a simple coating of tin upon the iron, and that the following is a full and exact description of my said invention.

The purpose which I have in view is to preserve the iron more effectually from rust, and consequently to render the plates much more durable than heretofore, when employed for the covering of roofs, the making of pipes, gutters, cisterns, bathing tubs, and various other articles. In order to attain this end, I cover the tin plates with a coating of lead, by immersing them in a bath of that metal in a state of fusion. For most purposes, I dip the plates singly into the lead, after having dusted them with powdered rosin, or any other suitable flux, after which I unite them together in the usual way.

When required for gutters, I generally groove the sheets together, so as to form strips of convenient length; these strips are then passed through the melted lead; immediately from the bath I cause the strips to pass between one or more pair of rollers, which rollers may be made of wood, or of metal covered with several folds of cotton cloth, or other yielding substance: these rollers I keep greased with oil or tallow.

I have thus described the mode in which I usually effect the proposed object, but I do not claim the particular implements or method employed as making any part of my invention; but what I do claim, and for which I ask a patent, is the covering of tin plate with a coating of lead, and applying the plates so coated to the purposes hereinbefore set forth.

JOSEPH M. TRUMAN.

ENGLISH PATENTS.

Specification of the patent granted to PEREGRINE PHILLIPS, JR. *of Bristol, in the county of Somersetshire, Vinegar Maker, for an improvement in manufacturing Sulphuric Acid. Dated March* 21, 1831.

To all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Peregrine Phillips, Jr. do hereby declare the nature of my said improvements is herein set forth and explained: but for the better understanding of the subject, I shall first describe the present mode of manufacturing sulphuric acid; next, the improvements I propose to effect; and then the means by which those improvements are effected. Sulphuric acid, or oil of vitriol, is generally manufactured at present by the combustion of sulphur, or brimstone, and saltpetre, either mixed together and placed in large leaded chambers, or separately in ovens connected with those chambers, into which chambers more or less of atmospheric air is admitted; the sulphur at first is converted by the combustion into sulphurous acid gas, and then, by the agency of nitrous gas, unites with oxygen from the atmospheric air in the chamber, or from that liberated from the saltpetre, and is thus converted gradually into sulphuric acid, which is afterwards absorbed by the water which covers the bottom of the chamber.

The first improvement then which I propose to effect, is an instantaneous union of the sulphurous acid gas with the oxygen of the atmosphere, and thereby to save the constant expense of saltpetre, and also the great outlay of capital in the chambers where any great quantity of sulphuric acid can be manufactured, by the gradual conversion of the sulphurous acid into the sulphuric acid. The second improvement I propose to effect, is to attain a more perfect condensation of sulphuric acid when made, by an improved mode of absorbing the same.

The first improvement then, namely, the instantaneous union of sulphurous acid with the oxygen of the atmosphere, I effect by drawing them in proper proportions by the action of an air pump, or other mechanical means, through an ignited tube, or tubes, of platina, porcelain, or any other material not acted on when heated, by the sulphurous acid gas. In the said tube, or tubes, I place fine platina wire, or platina in any finely divided state, and I heat them to a strong yellow heat, and, by preference, in the chamber of a reverbe-

ratory furnace; and I do affirm that sulphurous acid gas, being made to pass with a sufficient supply of atmospheric air through tubes as described, properly heated and managed, will be instantly converted into sulphuric acid gas, which will be rapidly absorbed as soon as it comes in contact with water. The sulphurous acid gas I cause to be generated by the combustion of sulphur or pyrites, or any other metallic sulphuret, in a close oven, having one or more apertures for the admission of atmospheric air, and another aperture leading to, or communicating with, the aforesaid tubes. The relative proportions of sulphurous gas and atmospheric air are regulated by the size and working of the air pump, which must pump out at least eighty-five cubic feet of air for every pound avoirdupois of sulphur consumed.

My second improvement, namely, a more perfect condensation of the sulphuric acid when made, I effect thus; I cause a chamber, or chambers, to be erected, of any size and materials that may be thought convenient, but by preference, of silicious stone, in a circular form, and about eight feet in diameter, and thirty feet high: this I cause to be lined, nearly, or throughout, with lead, to be filled nearly to the top with silicious pebbles, or any substance presenting an extensive surface, and not acted upon by the sulphuric acid. Upon the pebbles, or other substances, I place a sheet of lead pierced with small holes, for the better distribution of the liquor to be hereafter mentioned. The chamber is to be domed over, and rendered air tight on the outside, except by an opening on the top, through which a quantity of water, or dilute acid, is let in upon the pebbles to the height of about fourteen inches. A lead pump is fixed by the side of this chamber, drawing the liquor from its bottom, and emptying its contents into a lead funnel, placed in and over the aforesaid opening in the top of the dome, and which said pump is kept constantly worked by a steam engine, or any other power that may be preferred. The pipe of the funnel must be of such a size as always to keep some liquor in the funnel, and never to allow any air to pass down that way into the chamber; and the pump must throw a sufficient quantity of liquor to keep all, or the greater part of the pebbles moistened. A pipe, leading from the ignited tube, or tubes, after passing through some water for the purpose of cooling it, terminates in this chamber, just above the top of the liquor, whilst another pipe, going off from the top of the chamber, leads to the air pump, so that all the air charged with sulphuric acid, has to pass through the bed of moistened pebbles, which have a constant supply of water, or dilute acid, continually passing down them.

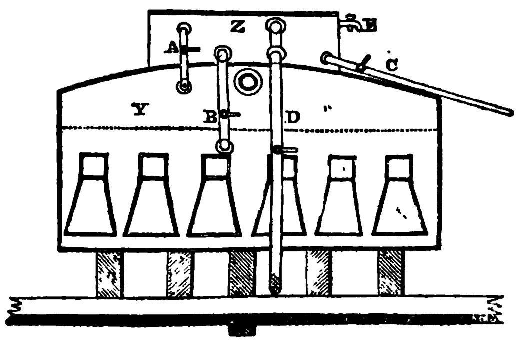
When the liquor is considered sufficiently charged, or when it will not absorb the sulphuric acid gas, which may be known by examining the air discharged from the air pump, it is to be drawn off by a pipe and cock in the bottom of the chamber, and treated in the usual way.

Note.—I do not claim a right to any mode by which sulphur or sulphurets may be converted directly into sulphuric acid by the action of heat or otherwise, if such method ever has been or ever shall be discovered; but I claim an exclusive right to any plan by which

sulphurous gas and atmospheric air, either alone, or mixed with any other gas or gases, shall be either forced or drawn by an air pump or any other mechanical means, through an ignited tube or tubes. I also claim the exclusive right to the use of platina in any finely divided state, for the purpose of assisting the action of heat in combining sulphurous gas with oxygen in the manufacture of sulphuric acid. I likewise claim an exclusive right to every mode by which chambers used in the manufacture of sulphuric acid, can be charged with silicious pebbles, or other substances, for the purpose of exposing extensive surfaces, and which surfaces can be either constantly or occasionally moistened by the liquor pumped or drawn from below them. [*Rep. Pat. Inv.*

Specification of the patent granted to SAMUEL SEAWARD, *for improvements in apparatus for economising Steam, and for other purposes.*

To all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Samuel Seaward, do hereby declare that my improvement, or improvements, in apparatus for economising steam, and for other purposes, are fully ascertained and described as follows, reference being had to the drawing hereunto affixed.



I form a vessel, Z, of iron, or other suitable material, and capable of withstanding the heat of the steam contained in the boiler, Y, and of resisting the pressure of the atmosphere, and of a capacity equal to one-twentieth of the water chamber of the boiler, or thereabouts; this vessel I call a receiver, and it is to be placed on the said boiler, Y, as shown in the drawing, or any where near the boiler, of a sufficient height, that any fluid contained in the said receiver, will descend by its own gravity into the steam boiler. To this vessel I attach four cocks, or valves, and as many pipes, in the following order, viz. one pipe, A, from the top of the vessel Z, to the steam chamber of the steam boiler; one pipe, B, from the bottom of the said receiver Z, to the water

chamber of boiler; one pipe, C, from the bottom of the said receiver to the water outside the ship; and one pipe, D, from the top of the said receiver, to the well, or lowest part of the ship, in which the boiler is placed.

The first operation of this apparatus for the effecting the saving of fuel, is as follows:—When the steam is so high as to raise the safety valves and escape, either in consequence of the engines standing still, or the too great quantity of fire, the cock A is to be opened, and the receiver Z filled with steam, the air rushing out by a small cock E, placed at the top. The receiver being full, the cock A is to be shut, and also the cock E, and the cock C opened; the steam contained in the said receiver will, by this operation, be condensed, and a partial vacuum thereby be formed; the water will then rush from outside the ship, and fill the receiver; the cock C being then shut, and the cock B opened, the water will descend slowly, by its own gravity, into the water chamber of the boiler; and this can be accelerated by again opening the cock A, by which means the water will descend at a heat not much below that of boiling water. The saving of fuel will be evident, because at all times, the boiler may be completely filled, and the water itself raised to a high temperature by the steam, which would otherwise escape at the safety valves, and be completely lost.

The second operation is that of pumping, or drawing the water from the hold of the ship. To effect this, the cock A is again opened, and the receiver thereby filled with steam; upon closing the cock A, the cock D is opened, and the water will rush up from the hold of the ship, and fill the receiver; the cock D being shut, and the cock C opened, the water contained in the receiver will run overboard by opening the small air cock E in the top. This operation can be repeated till the ship is perfectly dry: fifty or sixty tons of water per hour can be discharged with great facility in a boat of 10 horses' power, by simply employing the spare steam while the engines are at rest.

Now having described my improved apparatus, I do hereby declare that I claim the same when applied to the boilers of steam engines employed on board packet boats, and other vessels, for economising steam, and for the other purposes hereinbefore mentioned but not when employed for any other purpose.

Observations.

The advantages to be gained by the application of this apparatus are two-fold:—*first*, the most perfect economization of the fuel, inasmuch as all the steam generated in the boiler, is applied usefully; and, *secondly*, the application of the steam power in a most simple and efficacious way, for the purpose of pumping or discharging the bilge water out of the hold of the ship or vessel.

Any one who has been in the habit of witnessing the steam vessels on the Thames, for instance, must feel satisfied of the immense loss of steam, and, consequently, the expenditure of fuel, occasioned by

the steam roaring out of the waste pipes in the abundant manner it is accustomed to do, previously to starting, while running, and at the end of the voyage; for it must be borne in mind, that all the steam so escaping is attended with actual loss, carrying with it a great portion of heat, at the same time that the passengers are inconvenienced by the great quantity of warm water and argillaceous matter falling upon the deck. By the adoption of the present apparatus, however, the loss and the nuisance are both avoided, for the steam, instead of being allowed to escape, is condensed; the heat is secured and returned again into the boiler.

To be able, therefore, at all times when there is the least particle of steam in the boiler, to fill it up with water the required height for starting, and also to discharge any quantity of bilge water out of the hold of the ship, and that in a very rapid manner, without the aid or intervention of pumps, or even setting the engine to work, are advantages of too great consequence to be overlooked. All these advantages considered, we may confidently suppose that this apparatus will be found of no common importance to the interests of steam-boat proprietors, by rendering their engines more extensively available, and thereby increasing the value of steam-boat property. The expense of such an apparatus complete for 100 horses' power, would, it is presumd, be about £100. [*Rep. Pat. Inv.*

Patent grated to WILLIAM MORGAN, *of York Terrace, Regent's Park, Esquire, for improvements in Steam Engines.. Dated February* 141831.

THE ditovery here is to produce a perfectly rotary motion from the actionof a piston whose oscillation is but partial. Suppose the piston of a steam engine, particularly one of those for which Elijah Hollowayprocured a patent, oscillates within a cylinder, in a semicircular ation; or suppose it performs a greater or a smaller proportion of a erfect revolution. In this case it would be a manifest advantage, pplicable to a variety of purposes, which engineers and mechanics will at once comprehend, to procure from this imperfect revolution of the piston, a perfect rotary motion. This may be done in severa ways. By a chain, or strap, secured to a drum round the piston and to a beam, at the further end of which is a crank, two oscillations of the drum round the piston, and, relatively, of the beam, will complete a perfect revolution of the wheel at the end of the crank. The same effect may be produced by cog wheels in the drum and moveable beam, and by other means.

The improvement claimed by the patentee is, the production of perfect rotary motion from the partial oscillation of the piston of a steam engine. The means of producing this are various, and the patentee lays no claim to any express apparatus for the purpose. A beam attached to a knee, or joint, fastened on to the piston, and describing one porton of a circle, at the end nearest to the piston, and another

portion at its opposite extremity, may have a crank affixed to it in such wise, as to produce the same effect.

The improvement is evident, and the variety of its powers of application surprising. [*Rep. Pat. Inv.*

Notice of a patent granted to JAMES THOMSON, *Esquire, for improvements in making Printing Types. Dated February* 14, 1831.

AN indictment for arson charges the wilful fire-raiser with malice aforethought, and diabolical designs against our lord, the king, his crown and dignity; in that he, the aforesaid fire-raiser, did, at time and place aforesaid, with intent aforesaid, kindle many fires, to wit; two fires, &c. &c. with intent that the said fire should burn to the end of the world.

However true or false this description may be of the beginning of a fire, it is strictly applicable, changing malice into benevolence, to him who makes and publishes a useful discovery. However trivial in itself, its flame may burn to the end of the world: and as each passer by throws his portion to the flame, it augments incalculably.

Thus, the inventor of types of wood, would be astonished at the sight of fonts of metal, and the modern compositors were staggered when distinct letters were cast by a page at a time, in the shape of stereotype plates.

The present discovery would surprise the inventor of stereotype. It is to reduce the plates of metal back to single types; not, however, as the rupees and pagodas of India are struck from a silver sheet of the veda; but the necessary letters being first set up with wide spaces, and broadly "justified," as the compositors say—that is, widely divided between the lines, the mass is put into an iron box, and a plate cast thence, precisely as is the case with stereotype; the plate, however must be as thick as the type is to be long. By the operation of one or more circular or common saws, the plate is again subdivided into letters, which are used as types are. [*Ib.*

Notice of a patent granted to JEREMIAH GRIME, JR., *Copperplate Engraver, for a method of Dissolving Snow and Ice, on the Trams or Rail-ways. Dated February* 21, 1831.

MR. GRIME'S invention would effectually answer the purpose intended, provided he had been satisfactorily explicit upon one branch of the provisions required to bring it into action. This will be alluded to in its proper place. The main obstacle we anticipate, and which would occur to every reader of his specification, is the enormous additional expense that, upon its adoption, would accrue to the proprietors of the rail-ways. He proposes to lay by the side of, or under the trams, tubes, for the purpose of conveying steam or boiling water, which is to be prepared in boilers at equal distances of two

or three miles apart upon the road; each boiler to have a connecting cistern to receive the cold water from the hollow tubes or trams, with, of course, a feeder to supply them with the hot water or steam. The latter operation can be easily effected upon the principle of its expansive power; Mr. Grime, however, so far as we have examined and comprehended his plan, has not explained the mode in which he proposes to feed the cisterns with the cold water already in the tubes; that is, taking for granted that the tubes are already filled with cold water, how this is to be returned to his boilers for the purpose of being heated we are not told.

To allow for the expansion of the metal, he has provided "small copper sliding tubes, to be inserted in cavities formed in the joints to receive them, and in order to provide for a renewal of this sliding tube when it becomes so much worn as to leak. [*Ib.*

Notice of a patent granted to William Allen, *London, Piano Forte Maker, for "improvements in Piano Fortes." Dated the 20th July,* 1831.

Since the introduction of cast iron frames for piano fortes, considerable expense has been incurred in drilling the holes for, and fitting in, the pins, by which the strings are brought to any required degree of tightness, and considerable difficulty has been experienced in making the tightening pins fit into the holes, so as to turn with facility, and at the same time to preserve their position, and the required tension of the strings. These objections to the cast iron frames Mr. Allen has remedied, simply by casting the two dove-tailed grooves along that end of the frame where the tightening pins are to be inserted, and driving pieces of wood of a corresponding shape to fill up the dove-tailed grooves, and to receive the turning pins. It is evident that by this ingenious and simple contrivance, the expense of manufacture will be diminished, and the instruments will be improved. [*Reg. of Arts.*

Notice of a patent granted to William Alltoft Summers, *Engineer, and* Nathaniel Ogle, *Esquire, for their having invented certain improvements in the construction of Steam Engines, and other Boilers, or Generators, applicable to propelling Vessels, Locomotive Carriages, and other purposes. Sealed* 13*th April,* 1830.

The steam boiler, or generator, described by the inventors in their specification of the above patent, and claimed by them as their invention, consists in forming the boiler of a number of tubes or cylindrical chambers, placed in a vertical position, having other smaller tubes, or flues, passing through them, for the passage of the hot air or ignited gas from the furnace below; the larger tubes or chambers

contain the water to be heated, and are connected together at both ends by horizontal tubes or pipes. The supply of water is forced into the vertical chambers by a force pump through the horizontal tubes at the bottom; and from the upper horizontal tubes, the steam is passed by a pipe off to the engine.

The inner tubes, or flues, form a complete passage for the heated air, from the furnace crosswise through horizontal tubes, and throughout the larger cylindrical chambers from end to end; the whole apparatus is surrounded by a casing of metal, by which the heated air is also made to pass up through the spaces between the outsides of the larger cylindrical chamber; whereby the water contained in them is exposed to a very much extended surface of heated metal, on both the insides and outsides of the cylindrical chambers.

The patentees state, that they do not limit their claim of invention to any precise form, as the tubes, or vessels, may be elliptical, or of any other convenient form which would answer the purpose; but they claim as their invention the placing of an inner flue, or tube, for the escape of the heated air, or gas, arising from the fire inside a larger tube or vessel, in a perpendicular position; the said inner flues running through the inside of the larger tube, or vessel, and out at the top, the larger vessel being also placed in a perpendicular position. [*Lond. Jour.*

On Sugar from the Seckel Pear.

[The following communication from Mr. Brasier to the College of Pharmacy, was deemed of such importance as to be referred to a committee, whose able and detailed report we also have the pleasure of laying before our readers. Should experiments on a large scale prove equally satisfactory as those of Mr. Brasier, there can be but little doubt of the great value of this fruit in the manufacture of sugar. The greatest drawback to its extended propagation for this purpose is the time required for the tree to come to maturity, though, when an orchard has once reached the bearing age, the expense of procuring the sugar from the fruit will be incomparably less than that incurred either in the cultivation of the cane or of beet roots. We trust in the course of the ensuing year to present the results of further experiments on this subject, and we would suggest to such of our readers as have the opportunity, the value of comparative examinations of the juice of various other varieties of the same fruit.]

Philadelphia, October 20th, 1831.

The remarkable sweetness of the Seckel pears, which are cultivated at the country residence of my father, induced me to attempt to obtain sugar from them. In 1826, I commenced experimenting on them, with a view of separating the saccharine matter they contained: after treating the juice with lime, I concentrated it until its boiling point stood at 230° Fahrenheit, (the degree required for crys-

tallizing sugar,) and obtained a sirop of a pleasant taste, and of the colour of fine molasses.

The two succeeding years I obtained nearly the same results, but the sirop, as in the other case, would not crystallize; I have some at present, which still remains in the same state.

But in 1829, the season being favourable for fruit, I procured some very fine, the juice of which, (it was a grayish colour with a light tinge of orange, which last colour deepens in a very short time,) I heated nearly to the boiling point, neutralized and separated the feculent portion by treating it with an excess of lime, which, when precipitated, left a clear aqueous sirop of a light straw colour, of the specific gravity of nearly 1075. I then neutralized the excess of lime remaining in the sirop, concentrated and clarified it with ivory black, and reduced it until its boiling point marked 220° Fah. Having been prevented from attending to it for a few days, when I proceeded to terminate the concentration, I perceived that it had become so glutinous and ropy, I feared it would burn in the operation; I therefore put it into white glass bottles. It was clear, and of a fine yellow colour.

Eighteen months after this, some fine white crystals had formed, resembling those from sugar cane; (rock candy.)

Last summer I treated some juice in the same manner, but owing, I believe, to the unsoundness of the fruit, (the season being unfavourable,) the sirop was dark, and acquired a taste from the ivory black, which was of inferior quality. I then exposed the sirop in evaporating pans, in a hot atmosphere; it thickened, but has not yet crystallized, whilst the glutinous sirop of 1829, crystallized almost entirely, although the crystals were darker than those formed while cold.

Business calling me from the city, I submit to you the experiments, that you may continue them if you think proper, and take the liberty of calling your attention to a fruit which, though of a delightful flavour, is scarcely known beyond the vicinity of this city. I estimate its value for sugar, from the knowledge that its juice can be as easily and cheaply obtained as that of the apple, and that it contains near two pounds liquid sugar per gallon, whilst its agreeable flavour and sweetness leave little doubt of the quality and strength of the perry or vinegar that could be obtained from it.

That these feeble instructions may lead to the creation of a new branch of industry, is the sincere wish of

Your obedient servant,

AMABLE J. BRASIER.

The committee to whom was submitted the sugar and sirops prepared by Mr. Brasier, and presented by him to the College, beg leave to report:

That so far as they have been able to ascertain, the sugar obtained by Mr. Brasier from Seckel pears, possesses all the properties of the crystallized cane sugar, and in no respect does it seem to differ from it. Its taste, crystallization, solubility in water, &c. are exactly the same. Three samples have been submitted to the college; the

one very white, and in regular crystals; another, a little inferior; and the third sample, in a granular state, of a grayish colour, possessing the appearance and smell of dry Brazil sugar of an inferior quality.

Mr. Brasier left for the committee, two bottles of sirop made from the Seckel pear; one containing the sirop made in 1829, and which afforded the samples he produced; the other was the sirop he made last year. The principal object of the committee was the investigation of these two sirops, with the view of depriving them of their glutinous properties, as this was probably the only cause of the difficulty in the one case, and the impossibility in the other of obtaining crystallized sugar. Your committee having at their disposal but a small *quantity* of these sirops to experiment with, had little hope of success; but they have not been deterred from undertaking the task, though their experiments may have proved few and unsatisfactory. They expect to be able next year to institute a series of new experiments upon the fresh juice of the Seckel pear, and to submit to the college a more ample and satisfactory report than this. Mr. Brazier's discovery involves, undoubtedly, a very important question—whether the northern climates are not as capable of producing sugar as the *tropical*. We hope that your committee will receive the assistance of persons interested in the promotion of science, manufactures, and national wealth, and that scientific and enterprising men, led towards the same object, will communicate to us the result of their own labours.

The first sirop made in 1829 is perfectly transparent, of a light straw colour, and holding in suspension a considerable number of small prismatic crystals; its consistence is viscous and ropy, and its sp. gr. 1.365; heated in a sand bath it became more fluid, but still retained its ropiness; the crystals which floated in it when cold, fell down when heated; owing to its viscidity, it mixes with difficulty in cold, but dissolves readily in warm water. In contact with sulphuric acid, it acquires a deep brown colour, without emission of sulphurous acid: nitric acid decomposes it with production of nitrous vapours and formation of oxalic acid: muriatic acid did not seem to have any action upon it. Sub-acetate of lead and alcohol rendered it turbid, and precipitated a flocculent matter.

Six drachms of warm sirop were mixed with three ounces of alcohol, (distilled from grain,) of 35° of Baume's areometer; the mixture became turbid, and a white precipitate of flocculent matter subsided gradually; this precipitate was removed by filtration, and carefully washed with tepid alcohol. The alcoholic liquors were united and slowly evaporated at a heat of about 160.° When reduced to the crystallizable point the sirop had lost all its ropiness: carried to dryness it produced five drachms of very white sugar, impregnated with the smell of whiskey, and slightly contaminated with a little uncrystallizable sirop. After washing this sugar with alcohol, it was redissolved in distilled water, and the sirop, reduced to the crystallizable point, was entirely deprived of its former ropiness, and deposited, on cooling, a number of small crystals of pure sugar; what remained on the filter was found next morning to be a hard substance, much

reduced in size, and weighing four grains only. This substance, examined with the glass, presented the following characters—it was of a red brown colour, shining and hornlike on the side exposed to the contact of the air; on the other side it appeared spongy, porous, and of a lighter colour: its sp. gr. was great. Thrown into boiling water, it did not dissolve, but became white, and considerably larger; it continued, however, to sink in water. This substance had many of the characters of gluten, but submitted to the action of the fire it did not evolve an ammoniacal odour; it burnt with a black smoke, and emitted an odour similar to lignia, leaving for residuum a piece of charcoal about one-fourth its former bulk; another piece withdrawn from the boiling water, and submitted to a gentle heat, gradually resumed its former bulk, hardness, and colour. Iodine had no action upon this substance, but hydrochloric acid dissolved it completely.

The brown sirop of 1830, was treated in the following manner—two ounces were dissolved in one ounce of boiling distilled water, and then mixed with six ounces of alcohol of 35°. The mixture became turbid, and a copious precipitate fell down; this precipitate separated from the alcohol, did not adhere to the fingers, and could be malaxated like warm molasses candy. This precipitate dissolved easily in boiling water, but sweetened it very little. A portion of it permitted to dry in the air, acquired a deep brown colour, shining at the surface, and spongy inside, of a sweetish taste, somewhat like the flesh of a dry raisin. Thrown upon an ignited coal, it swelled up, took fire, and burnt with the smoke and smell of a woody substance, but without emitting either an ammoniacal or burnt sugar smell.

The same filtered solution was then treated with sub-acetate of lead, which threw down a very copious precipitate; the liquid became considerably lighter in colour, and after being filtered, a stream of hydro-sulphuric acid was passed through it to precipitate the lead; it was filtered again, after ascertaining that it was entirely free from lead. The liquor now reddened litmus paper, but the acidity was soon removed by boiling. It was then evaporated to the consistence of a thick, transparent sirop, of the colour of light Madeira wine, which was set aside to crystallize, but did not, after remaining several days.

It may be inferred from the above experiments, that the difficulty experienced by Mr. Brasier in crystallizing his sirop of Seckel pear, was owing, principally, to a peculiar mucous substance which he did not separate sufficiently by the process he followed in his operation, and which rendered his sirop viscous and ropy. The sirop made in 1830, evidently contained a much greater portion of this mucilage than the other, and was, besides, as we learn, submitted to a very protracted action of heat, which is known to deprive solutions of sugar of the property of crystallizing. We have hardly any doubt that a better process than that resorted to by Mr. Brasier may be applied to the manufacture of sugar from the Seckel pear, and we are disposed to think that the employment of the sub-acetic of lead, instead of lime, for precipitating the vegetable, mucous, and colouring

principle, will obtain the desired object. This means has already been proposed for the purification of cane and beet sugar, but as the salts of lead combine with sugar, and are separated from it with difficulty, it was abandoned. However, it is asserted in the Dictionnaire des Drogues, that some manufacturers have succeeded in this desideratum, and that this method will, before long, produce a great revolution in the art of sugar refining.

Now the question is, whether the manufacture of sugar from the Seckel pear may become an object of industry and of advantage to the country. The solution of this important question is yet beyond our reach; our data, in reference to this point, are altogether insufficient, as we have no means of establishing a comparison between the quantity of sugar that two similar portions of land might afford, if cultivated, one with sugar cane, and the other with Seckel pear trees, nor between the relative costs of cultivation and manipulation. However, if we compare the richness of the juices of sugar canes, beet roots, and Seckel pears, we shall find that the last possesses a great superiority over the others. According to Mr. Gillmer, (Dictionnaire des Drogues,) Mr. Achard, a distinguished chemist, and a manufacturer of beet sugar, obtains four, to four and a half per cent. of sugar from the juice of red beets. Edwards, in his history of the West Indies, relates that the average quantity of sugar obtained from the juice of the cane, is about ten per cent.; now Mr. Brasier tells us that one gallon, or eight pounds of Seckel pear juice, yields two pounds of liquid sugar,* that is, 24 ounces of dry sugar, or *18.75* per cent., about twice as much as the juice of the cane. Thus if the assertion of Mr. B. be correct, which we confidently believe, a Seckel pear tree, producing four bushels of pears of 60 lbs. to the bushel, would yield three-fourths their weight of juice, or 180 lbs., which would produce 34 lbs. of dry sugar; and one acre of ground, planted with *100* Seckel pear trees, each producing four bushels of fruit, will yield *3400* lbs. of dry sugar,† without preventing the soil from affording other agricultural products.

The genus Pyrus, (pear tree,) belongs to the class Icosandria, order Pentagynia of the artificial system of Linnæus, and to the family Rosaseæ of the natural order. It was divided by Linnæus in three divisions; the Pyrus proper, *P. malus* and *P. Cydonia*. Persoon has separated the latter from the genus Pyrus, and formed a new genus under the name of Cydonia. From five species of Pyrus described by Persoon, the *P. communis* is the only one bearing fruit, which, by cultivation, is susceptible of becoming eatable.

In the natural state, the pear tree acquires considerable dimensions, and its branches are frequently terminated by long, straight,

* One pound sugar, made up in sirop, gives one pint of the latter, weighing one pound five ounces avoirdupois.

† Each face of a square acre, containing 4840 square yards, is 69.6 yards long. or 208 feet. By leaving fourteen feet free from the edge of each of the faces of the square acre, to the first row of trees, and planting the trees at twenty feet distance from each other, it is found that one square acre will contain ten rows of ten trees each.

and hard, prickles; its fruit is acerb, hard, and its flesh granular. This single species has, by cultivation, produced a great number of varieties, which are propagated by grafting, and distinguished by difference in shape, size, and colour, and especially by the taste of the fruit. Tournefort arranged these different varieties into three different classes; the Summer, the Autumnal, and the Winter pears. The pear which is the subject of this report belongs to the second class. It is known by the name of Spicy, Musk, or Russet pear, and is called by the French *Rousselet de Rheims.*

The Seckel pear derives its name from a gentleman of this city, who, it seems, was the first who paid particular attention to the fruit, and to spreading the tree among his friends and the public. However, Dr. D. Hossack, in an account of the Seckel pear, which was published in the third volume of the Transactions of the Horticultural Society of London, asserts, on the authority of a respectable friend, that seventy-two years ago, this pear was grown in the neighbourhood of this city, by a person of the name of Jacob Weiss, who had obtained the tree at a settlement of Swedes which was early established in the vicinity of Philadelphia, and that most probably Mr. Weiss, and the father, or grandfather, of Mr. Seckel were intimate, as both families were Germans, and of that rank in society which might be likely to lead to such an acquaintance. The conjecture therefore is, that under such circumstances, Mr. Seckel's family obtained the grafts from Mr. Weiss's tree; however this may be, Mr. Seckel deserves the credit of having propagated this delightful fruit, and having paid the greatest attention to the cultivation and melioration of the tree.

That the Seckel pear tree is a native variety of the neighbourhood of Philadelphia is incontestable, from the circumstance that it is hardly known out of the vicinity of this city, and because it has never been described by European horticulturists, except from the descriptions of our own authors, and as having been procured from this vicinity. There are already several sub-varieties, slightly differing in size, colour, and taste.

It is thus described by Mr. Cox, in his work on the fruit trees, published in this city in 1817. "The fruit is generally small, round at the blossom end, diminishing with a gentle swell towards the stem, which is rather short and thick; the skin is sometimes yellow, with a bright cheek, and smooth; at other times it is a perfect russet without any blush; the flesh is melting, juicy, and most exquisitely and delicately flavoured. The time of ripening is from the end of August to the middle of October. The tree is singularly vigorous and beautiful, of great regularity of growth, rich in foliage, and very hardy, possessing all the characteristics of a new variety, and, as a native tree, it is but little affected by that species of blight, commonly called fire blight, which, in this country, destroys so many pear trees of the imported varieties." A good representation of this fruit, copied from a drawing executed by Mr. Cox's daughter, has been appended to the account given by Dr. Hossack, and published in the Transactions of the London Horticultural Society.

The Seckel pear may be cultivated, and will flourish, on almost any species of soil; it should always be grafted or inoculated on the wild pear tree, as grafting on the quince tree subjects it to the same diseases with which this tree is generally affected in this country. It should be four or five years old when planted in the orchard, and each tree at a distance of from eighteen to twenty-five feet. Many horticulturalists whom we have consulted, prefer the smallest distance, or twenty feet at most, as by this method the trees protect each other from the wind, frost, sunbeams, &c.

It bears fruit at from five to six years old; at that age the product is trifling, but from eight to twelve years it increases considerably; when fifteen years old they are in full bearing, increasing, however, until they are twenty-five. Their average product, from fifteen to twenty-five or thirty years old, is variously reported, and there is generally one good and one bad year. The minimum product seems to be, on an average, four bushels of fruit.

It acquires considerable size, and lives forty, fifty, and as long as sixty years. The general experience is, that it is very little subject to the diseases afflicting other trees, more easy to cultivate, and bearing generally more fruit than any other.

Your committee have thus given as succinct an account as practicable to do justice to the subject, although they have extended their report far beyond the limits they had originally prescribed; yet they would do injustice to Mr. Brasier, as well as their own feelings, if in concluding the report, they omitted to say, that they consider him entitled to great praise for the talents, perseverance, and ingenuity he has evinced in the prosecution of the experiments, the results of which they have been examining, as well as those which have enabled him to saccharify, *directly*, rye, and other kinds of grain, the sweet and common potato, and other vegetable substances containing fecula, by means of the combined action of heat and water, acidulated by sulphuric acid, and afterwards to convert the liquid sugar thus obtained into alcohol, and cannot but believe that the ultimate results of them will prove highly important to the country.

E. Durand,
Jos. Scattergood.
[*Jour. Phila. College of Pharmacy.*

To the Editor of the Repertory of Patent Inventions.

Sir,—If the communication, which I send herewith, comprising "Observations on the preservation of lives from Shipwreck," &c. so far meet your approbation, and be so far consistent with the plan of your work as to obtain a place in its valuable pages, I shall probably trouble you again with a few thoughts on other subjects, and am,

Sir,

Your obedient servant,

Bristol, September 6. E. H.

Observations on the preservation of Lives from Shipwreck, with a suggestion for the employment of Sky Rockets. By EDWARD HODGES, *Mus. D.*

THE calamitous instances of the wholesale destruction of human lives by shipwreck, which have lately occurred, more especially the recent case of the loss of the Rothsay Castle, by which more than a hundred souls were hurried into eternity, have called the attention of most reflecting minds to the subject of the possibilities and probabilities of preservation from such disastrous accidents. Many have been the plans heretofore devised to carry into effect so humane and laudable an object; yet fresh instances of marine calamity are constantly calling forth other schemes, which perhaps attract attention for a little while, are acted upon probably in one or two instances, and then are heard of no more.

Still it is to be hoped that eventually some settled principles of action may be arrived at, and made generally known as well to those who plough the mighty deep as to the inhabitants of our coasts; principles of prevention, and principles of remedy, when danger threatens or direful accident takes place. As a contribution towards this desideratum, I will endeavour to suggest a few observations, some *one* of which may possibly hereafter conduce to the preservation of the life of a fellow subject, and if *but* one, my labour will meet with an ample reward.

With regard to the total prevention of shipwreck, it is evidently beyond the reach of human wisdom or foresight. Storms, tempests, and hurricanes, doubtless will continue to agitate the ocean; and whilst man shall continue to trust himself upon its bosom, he will ever be exposed to their occasionally fatal influence. But it does not therefore follow that he ought to neglect all precautionary measures—that he shall tempt the treacherous deep in a frail vessel, the certain prey of the first boisterous gale he may encounter—that he shall omit to provide himself with the most approved nautical apparatus—that he shall disregard the friendly admonitions of beacons and lighthouses, warning him of sunken rocks and hidden dangers—or that he shall despise even a landsman's well meant, although perhaps not technically expressed, hints for his farther security, from or during moments of impending destruction. Trusting then that my remarks may be received with good humour even by nautical men, I will venture to proceed.

The principal dangers to which a ship is exposed are three; fire, foundering at sea, and striking or running on shore; which last is what is most commonly understood by the term shipwreck.

With respect to the first and second of these, (as far as the second may be the result of *leakage*,) I offered some suggestions many years ago, to several mercantile gentlemen, who, however, denounced my idea as impracticable, because it would impede *stowage;* the stowage of a cargo being considered a matter of much greater importance than the safety of the passengers and crew. The plan perhaps was

not likely to be *profitable*, and certainly would prove somewhat expensive, and, consequently, could not be expected to meet with even partial adoption. It was published in one of the provincial papers, and in consequence of the loss of the *Comet*, in 1825, was then again brought forward in the Bristol Mirror, in which its peculiar adaptation to *steam-boats* was especially pointed out. *It proposed the division of the hull laterally into three distinct holds or compartments, having no communication with each other.* The partitions were to be as substantial and water tight as the sides of the vessel, so that should the water gain access to one-third, the other two would preserve their buoyancy. This arrangement, it is evident, would be advantageously applied to ships engaged in the *corn* trade, or in carrying any other merchandise for the deterioration of which by damp, &c. the underwriters are not liable. In case of *fire* one part of the ship might be scuttled, or deluged, without injuring the next; besides the increased chance of *stifling* it in its origin: and in the event of bursting a boiler on board a steam vessel, such a provision would be found of no mean utility. There can be no valid reason assigned why such a proposal should not be acted upon with reference to those steam-boats which are constructed for the purpose of conveying *passengers* rather than *goods*. The anxiety and apprehension of the public having been generally roused by the late fearful death-dealing accidents, such a *safety boat* as is here recommended, would undoubtedly be preferred; and thus, for once, the love of money may be enlisted on the side of humanity.

People are frequently exposed to greater danger on board of steamers than those of which they are at all aware. I remember, some few years back, witnessing a circumstance which placed my own life, as well as the lives of forty or fifty others, in jeopardy. This happened on board a small steamer, which was then running in opposition to another, both designedly starting at the same time. A few minutes previously to starting, the steam being well up, I observed the man who acted as engineer, *placing additional weights upon the safety valve.* Not content with such small matters as were lying near at hand, he fetched a large iron spanner, weighing several pounds, and placed that also upon it; and it was not until I had suffered the infliction of some abusive language, and threatened not only to leave the vessel myself, but to alarm the other passengers, that I succeeded in inducing the heedless fellow to remove the obnoxious additions to the customary working-weight of the engine.

Such instances of murderous indiscretion are, it is to be hoped, rare; but the public will not much longer rest satisfied without something more than a mere *hope* that the engineer is not only an experienced, but a careful and trust-worthy man. They must also be thoroughly assured that the other officers are individuals not only of skill but of sobriety; and that the vessel itself is sea worthy, and properly manned and appointed. If no legislative enactment enforce this, (which is much to be wished, for the safety of his Majesty's lieges, and which assuredly would throw no obstacle in the way of the honourable exercise of the steam trade,) the prudential considera-

tion of the public will eventually prevail; and perhaps after a few more Comets, and Frolics, and Rothsay Castles have been the means of engulfing fresh hecatombs of victims, the owners of such craft will find themselves under the necessity of certifying periodically, under competent authority, that their vessels and engines are in proper condition—that they have secured the services of skilful and prudent officers—and that they have provided all possible means of preserving lives in the event of unavoidable accident.

But after all the precautionary measures which ingenuity may suggest, or wisdom may devise, have been adopted, casualties will still occasionally occur, and the agonizing shrieks of shipwrecked men, women, and children will again be heard to mingle with the hideous roar of the midnight hurricane, and the awful under growl of the tumultuous Atlantic, as, in its "foaming fury," it beats against our iron-bound shores. This is the time for calling into activity every muscle of the body, and every energy of the soul; and accordingly we find that on such occasions individuals have ventured their lives, and performed feats of almost incredible heroism, in rescuing their fellow sufferers from a watery grave.

Life-boats, and various kinds of apparatus for projecting lines and ropes, have from time to time been invented, and happily, (when at hand,) have not unfrequently been the means, under Divine Providence, of saving many from destruction. Honour be to the inventors of such praiseworthy contrivances, amongst which I cannot but number the simple, yet highly promising method devised by Lieut. Cook, of converting a boat used for ordinary purposes into a life-boat, by means of a canvass deck, as described in the Repertory, No. 77, for August, 1831. But alas! in how many fatal instances have these appliances been wanting. How commonly do we hear of a wreck taking place at a part of the coast where no assistance was at hand—no friendly life-boat to take off the perishing sufferers—no Captain Manby's, or Mr. Murray's apparatus to effect a communication by means of a rope, even when the distance was practicable, and no sort of provision found on board for so lamentable a contingency. And in how many instances, even when at hand, do they unfortunately fail of success; in some, even augmenting the calamity by the fruitless sacrifice of lives engaged in the benevolent work. Thus frequently are all on board left to perish, saving, perhaps, one or two poor mariners, who reach the shore, scarce knowing how, wafted to some place of safety by the special favour of heaven.

The first grand desideratum in all such cases, is to get a line, or hawser, on shore. This matter once achieved, the daring activity and courageous self-possession of sailors quickly enable them to attain to terra-firma, and their ingenuity soon contrives, by the same means, to effect the deportation of those of their passengers who may not be endowed with the requisite strength and nerve to contribute in any material degree to their own rescue. Now it is obviously much more rational to provide a ship with *the means of throwing a line ashore*, should she chance to be stranded, than to trust to the uncertain possibility of an apparatus being provided on land; as she may strike on

the coast of some desolate island, or be stranded on some barbarous shore, where all such contrivances are utterly unknown.

The plans proposed for effecting this desirable purpose are by no means so numerous as might have been expected. The first thought is that of carrying out a line by means of a boat; but probably the boat is swamped in the first or second attempt, and thus this hope is cut off. *Storm-kites* have been proposed, to be constructed upon the wreck, wherewith to waft a line with the grappling-iron attached. To say the least, such a species of manufacture is not likely to be efficiently executed under such circumstances. The ingenious Mr. Pocock has, in his patent kites, improved upon the idea, and rendered the scheme more practicable, by inventing a method of folding them up, so as to be enabled to keep large kites stowed in a very small space, and capable of flight after but a few minutes preparation. Besides this, their manageableness when mounted, and the tractability with which they may be raised or lowered, and veered right or left, eminently entitle them to the notice of nautical men, for this as well as for other services.

Captain Manby's apparatus, being somewhat cumbrous, not being serviceable on other occasions, besides being liable to the objection that the sudden velocity given to the shell frequently snaps the line, although now in use for some years, makes but little way towards a general adoption on board each individual ship. On land it will no doubt continue to be most effectively employed.

Mr. Murray's *arrow*, to be discharged with a line, from a musket, as being much more portable, seems to promise more universal utility; but it is liable to the objection that having no grapnel attached, it must be nearly confined to the service of throwing a line from the shore to the ship, not from the ship to the shore, unless indeed, in the latter case, friendly parties were at hand to assist by making it fast, or by hauling upon it, which evidently cannot be expected to be always the case even on our own island.

I know not whether the employment of the *sky rocket* on such occasions has ever been suggested or not, but it seems to me to be one of the most likely means of effecting a communication. A powerful rocket will carry with precision, to a great distance, a very considerable weight, and probably might be made to convey not only a small line, with a grappling iron attached, *but even a double line reeved through a block*, so as to enable the unfortunate parties on board to haul a stronger rope on shore without farther help. It will be necessary to attach a few yards of light chain to the rocket, so as to keep the line clear of the shower of fire to which it would otherwise be exposed; and then, I doubt not but that the rocket will prove as effective an instrument in the preservation of lives, as in other hands it has been rendered conducive to their destruction. The rocket would at the same time operate as a signal of distress.

If this suggestion be considered worth a trial, I leave it for those who may be more interested in the result than I am, and who are possessed of better means and opportunity to try the experiment. I only add, that I presume the chain must be attached about the centre

of the stick, or between that point and the rocket; but this, actual experiment alone can determine.

Having thus started one idea, I pass on to make a few remarks upon the other means of saving endangered lives, by the employment of rafts, or floats, and by attaching to the person buoyant substances of divers kinds.

Sailors have long been justly celebrated for the expertness and despatch with which, under such untoward circumstances, as those that ordinarily attend the occurrence of shipwreck, they contrive and construct a raft; but they do not appear in such cases to have uniformly turned their empty water casks to the best possible account. True that a single empty cask, notwithstanding its buoyancy, forms a very untrustworthy support for a drowning man; it constantly eludes his grasp, and perhaps even hastens his destruction. But *two* casks lashed together would form an effective support to two or three individuals, who might thus be wafted on shore. A *series of casks* thus strung together would be still more serviceable, and although some few, perhaps many, of the parties trusting to them might be seriously injured, or even killed, by the violent collisions which might be expected occasionally to take place between them, yet the probability is, that the greater number could be saved.

The *cotton jackets* to be inflated with common air, which have lately been invented, seem to promise much, and I trust, will soon be brought into general use. But the material is so frail that it would certainly be preferable to make the jackets of the patent *air-tight cloth*, of which the inflated beds and cushions are constructed. This substance would be less likely to be rendered unserviceable by an accidental scratch or collision with any sharp or pointed body. Where would be the harm of requiring that every steam-boat should carry a number of these life-jackets, equal to the average number of passengers? Prudence, however, would dictate the propriety of each individual furnishing *himself* with a garment of this description, which might be made either in the shape of a waistcoat, or in that of a shooting jacket, and would be by no means an unsightly article of attire. It would be well if these life-preservers were made to consist of two, three, or more, separate air-cells, having no internal communication, and of course, therefore, to be separately inflated; when, in the event of damage or leak in one part, the remaining parts would still be sufficiently buoyant to float the body.

With respect to the management as applied to the case of ladies, there would seem to be more difficulty; but I doubt not but that, if their modesty be so great that they would not put on a man's jacket even to save their lives, their ready ingenuity will quickly contrive the way to manufacture a female life-preserver in the shape of some useful or elegant piece of dress, *e. g.* a cloak, or a spencer, or a pair of handsome *balloon sleeves*, and so the foolish vagaries of fickle fashion herself shall be rendered instrumental in the preservation of life. Let the ladies see to it.

But these things will be in some degree expensive, and beyond the means of the poor, who constitute by far the majority of steam

travellers. What are they to do? Why, I recommend them to furnish themselves with a few *hogs bladders*, or the bladders of any other animal from a sheep upwards. Any man might with ease carry a dozen or more in his pocket, and if fastened in pairs with strong twine, he would upon emergency find them quickly available. With a pair attached to each arm, a man might float upon the waves for hours.

Had there been a basket or chest full of bladders on board of the Rothsay Castle, or the Frolic, how many valuable lives might have been saved! Had the steward of the former providently stocked himself with a good store of such commodities, instead of lashing himself and his hapless wife to the mast, and there in bitter and unavailing agony terminating his earthly career, the rational probability is, not only that both of them, and many of those who were involved in that terrific catastrophe, would have been saved, but that he in particular would have been *enriched by the adventure*, for assuredly he would have found no difficulty in disposing of his bladders *at any price*. Let all steam packet stewards then take the hint. Such a calamity may again occur, and in their own experience too; and in such an event they will find two or three guineas worth of hog's bladders a much more profitable speculation than a dozen hampers of porter, or ten thousand bottles of soda water. [*Rep. Pat. Inv.*

Power of Draught at different velocities, and on various kinds of Road.

TO THE EDITOR OF THE REPERTORY.

Sir,—Finding, upon conversation with a coach proprietor, that some very erroneous notions respecting the force required to draw a carriage under different circumstances, prevail amongst those persons who are immediately interested in being well informed on the subject, I am disposed to believe that the public generally, (with the exception of the scientific few,) are inoculated with the same errors, well knowing that it is usual to put implicit faith in what "practical men," (as they are called *par excellence*,) promulgate in their own particular avocation. It is almost universally said and admitted, that it requires *less* power to work a coach at a high than at a low velocity; and as this doctrine may lead some of your ingenious readers into very erroneous calculations, I am anxious to see introduced into your useful work, some account of the extensive series of experiments made by Mr. Macneil, (under the superintendence of Mr. Telford,) on the London and Liverpool road, in which the force of traction was very accurately ascertained by means of an improved dynamometer, invented by Mr. Macneil.

The general results of experiments made with a stage coach from London to Shrewsbury, a distance of 153¼ miles, on different inclinations, and at different velocities, are given in the annexed table:—

Rates of inclination.	Rates of travelling.	Force required.
1 in 20	6 miles per hour.	261
1 in 26	6	213
1 in 30	6	165
1 in 40	6	160
1 in 600	6	111
1 in 20	8	296
1 in 26	8	219
1 in 30	8	196
1 in 40	8	166
1 in 600	8	120
1 in 20	10	318
1 in 26	10	225
1 in 30	10	200
1 in 40	10	172
1 in 600	10	128

From the foregoing statement, it is evident that the power of draught required, constantly increases with the rate of velocity of the carriage, though apparently not always in a uniform ratio; owing most likely to the varying resistance even of the same piece of road in a different state of the weather.

Another piece of information furnished by Mr. Macneil's experiments, and inserted in Mr. Telford's report, I annex, as it appears to be of great practical value.

On a well made pavement, he found the force of the draught to be	33 lbs.
On a broken stone surface, on old flint road	65 lbs.
On a gravel road	147 lbs.
On a broken stone road upon a rough pavement foundation	46 lbs.
On a broken stone surface upon a bottoming of concrete, formed of Parker's cement and gravel,	46 lbs.

Hoping, Mr. Editor, that you will deem this subject worthy of the consideration of your readers,

I remain,
Your constant reader,
James Green.

Wine Office-court, Fleet street, Oct. 3, 1831.

Remarks on the foregoing.

We entirely coincide with our correspondent in his estimation of the data he has obligingly furnished us from Mr. Telford's Report, though we do not take quite the same view of the opinion quoted of the coach proprietor, who appears to us either to have mistaken the true fact of the case, or to have misstated it. If he had said that "it requires a less *quantity* of power to work a coach *a given distance*, (or journey,) at a high velocity than at a low velocity, we think he

would have been right, and that such will appear from the data, which Mr. Green has supplied us: we will, however, take leave, to place Mr. Macneil's table in a more convenient form for comparison and examination.

	Force required at		
Rate of inclination.	6 miles per hour.	8 miles per hour.	10 miles per hour.
1 in 20 - -	268 - -	296 - -	318
1 in 26 - -	213 - -	219 - -	225
1 in 30 - -	165 - -	196 - -	200
1 in 40 - -	160 - -	166 - -	172
1 in 600 - -	111 - -	120 - -	128
	917	997	1043

The second and fourth lines of figures, (1 in 26 and 1 in 40,) present some discrepancies, which we do not know how to account for. In each of these cases, we observe the increase of force required at the several velocities, is just six pounds, while the increase in the first and third is far greater, and they all vary considerably. The safest way, therefore, to calculate from such data, is to take the total forces at each velocity, which is shown above in 917, 997, and 1043. From these we may conclude, that a given load, which requires to draw it a force of

9¼ lbs. at 6 miles per hour, will require
10 lbs. at 8 miles ———, and
10½ lbs. at 10 miles ———.

Or, we may say, that it requires about *an eighth* part more of power to increase the velocity from six to ten miles per hour; in return for which we have an increased velocity of motion of *four-tenths*, which is a saving of nearly *three-ninths*, (or one third,) in the quantity of power expended in conveying a given load the same distance.

Let us suppose a journey from London to York and back, which we will call 600 miles, (it is nearly,) for the convenience of calculation.

At 6 miles per hour it will take 100 hours.
At 10 miles - - · 60 hours.
Therefore, 917 lbs. (total of 6 mile forces,) × 100 is 91,700
And 1043 lbs. (total of 10 mile forces,) × 60 is 62,580

Making a difference of force in favour of high velocity of 28,420 lbs.

Or nearly one-third, (three-ninths of 91,700,) as before mentioned; although it takes a *greater power during the same space of time* to draw at a high than at a low velocity: the gain being in the increase of space passed over by a given power in a given time. No advantage can, however, be taken of this circumstance, with carriages drawn by horses; as horses can exert but very little power of draught at high velocities, which makes it necessary to put four horses to run a coach load, that would require only one horse at a walking pace: and the

walking horse, though drawing four times the load of each of the runners, and working three times longer, would be less fatigued at the end of the same journey. But in locomotive carriages the case is otherwise, as in them all the great advantages which result from a high velocity may be made available; and it will be mainly owing to this circumstance that locomotive carriages will ultimately supersede the use of draught horses on the common road. We are inclined to believe that in less than three years hence, this will take place in fast-going carriages for passengers and burthen, and that a more gradual amelioration and change to the same system, will take place in the slower going vehicles.

The reader to whom this subject is novel, should be mindful not to mistake the data we have used in our *comparative* estimate, for the real power required to draw a coach load; that being only about a sixth part. Mr. Macneil's statement, given by our correspondent, relates only to *ascending* inclinations; and as 111 lbs. is given as the force of draught in an inclination of one in 600, at six miles per hour, we may assume from all the data given with respect to the effect upon different kinds of road, that 100 lbs. will be about the average force of draught upon a level, and as the momentum acquired in descents will compensate for the loss of it in making ascents, 100 lbs. is probably very near the truth. Taking that for our datum, the following table will show the comparative quantities of power and draught expended in travelling 600 miles at the several velocities of motion:—

Ratio of velocity.		Time of journey.		Distance.	Force of draught.	Comparative quantity of power expended.
6 miles per hour	×	100 hours	=	600 miles	100 lbs.	100,00
7 miles - -	×	85+ -	=	600 - -	104 lbs.	88,40
8 miles - -	×	75 - -	=	600 - -	107 lbs.	80,25
9 miles - -	×	66 - -	=	600 - -	110 lbs.	72,60
10 miles - -	×	60 - -	=	600 - -	113 lbs.	67,80

[*Reg. of Arts.*

Theoretical and Experimental Researches to ascertain the Strength and best Forms of Iron Beams, by EATON HODGKINSON.*

From the Memoirs of the Literary and Philosophical Society of Manchester, 1831.

"1. THE very frequent use of iron beams for supporting the floors of factories, and of other places crowded with people, renders it ex-

* We are indebted for the use of the work forming the subject of the following article, to our esteemed friend William Strickland, Esq., Architect. We purpose to make such extracts from it as will put our readers in possession of the valuable information which it contains; giving as much attention to the theoretical part of the work as will be necessary to present a correct view of its bearing upon the experimental researches.—COM. PUB.

tremely desirable that the best information should be obtained with respect to the strength of this material, in order to insure, without a great superfluity of metal, the requisite stability. In a case so deeply involving the loss of life, and where a failure would be attended with such serious consequences, hardly too much research can be applied. The scientific character of the subject also imparts to it additional interest; and we cannot, therefore, be surprised, that the strength of materials has engaged the attention of many of the most distinguished philosophers from the time of Galileo, who was the parent of these inquiries, to the present age; including the names of Bernoulli, Euler, Lagrange, Coulomb, and Robison.

"These great men have shown in its different departments, how the refinements of speculative science can be applied to practical purposes. They have done much—but owing perhaps to a disinclination to the labour and expense of making sufficient experiments, much was left undone for later inquirers. And in the lateral strength of bodies, after all the hypotheses that have been employed upon it, the practical man has been till lately without a general and satisfactory theory.

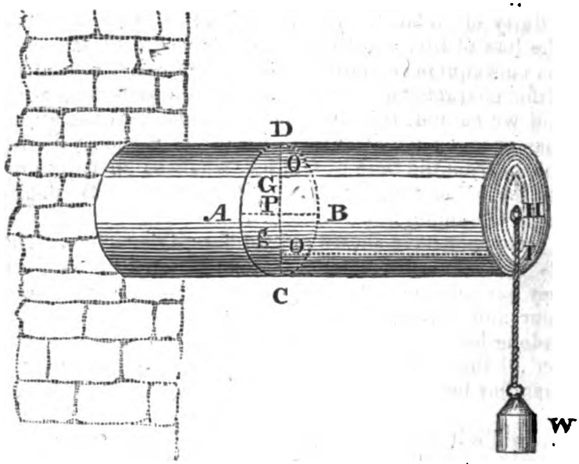
"2. But, while it is thus necessary to insure sufficient strength, it is very desirable that the beams should be formed in the manner best adapted to resist the strains to which they are subjected: and if, by an alteration from the usual shape, the same strength could be obtained with a smaller quantity of metal, the expense would be reduced; and the material rendered even capable of bearing more pressure, by having less to support in its own weight. It may be stated in illustration of this remark, that there are usually upwards of 100 tons of metal in the beams supporting the floors of a factory.

"3. To attain these objects, as far as lay in the power of the author of this paper, a number of experiments have been made; but before giving an account of them, it may be proper to describe the nature of the strain to which bodies thus acted upon are exposed."

"4. Suppose a beam, placed horizontally, with one end firmly fixed in a wall, and a weight hung at the other, it will bend: but, it is evident, this could not take place, except by the lengthening of the top parts, or the compression of the bottom, or by both. Now, both of these effects do actually take place; and hence, there is some intermediate point, or line, between the top and bottom of the beam, where the particles are neither extended nor compressed: all above being in some state of tension, and all below compressed. This line may properly be called the neutral line.

"If then, ADBC represent a transverse surface of the beam, and AB the neutral line, ADB must be the surface of tension and ACB that of compression.

Fig. 1.



"Now, it is evident, that the extensions or compressions of any particles within these surfaces, will be as their distances from the line AB; and the forces, exerted by those particles, must be in the same proportion, so long as the elasticity remains perfect; for then the forces are found to be as the extensions or compressions."

Afterwards the forces of the particles would vary in some different ratio of the distance.

The fact that the forces of the particles on each side of the neutral line are equal, furnishes a method of determining the position of that line.

The force of each particle in the surface of tension is represented by the product of that particle into its distance from the neutral line AB. The sum of the forces of the particles in the surface ADB, of tension, will give the force of tension produced by the weight W. By a well known property of the centre of gravity, viz. that it is the centre of mean distance, the sum of the particles in the surface ADB multiplied by their respective distances, may be represented by the surface ADB, multiplied by the distance of its centre of gravity, G, from the axis AB; that is, by the surface ADB multiplied by GP, (ADB $\times$ GP.)

In like manner, the force of compression, produced by the weight W, in the surface ACB, may be represented by the surface ACB multiplied by gP, (ACB $\times$ gP,) g being the centre of gravity of the surface of compression ACB.

If the resistance of the solid to extension be equal to its resistance to compression, then the two products found above will be equal. This, it appears by experiment, is nearly the case in cast and in wrought iron, but is not so, (according to some experiments made by our author,) in timber.

In general, then, the products found above to represent the forces of tension and compression, cannot be taken as equal, but we have always the proportion, as

*ADB $\times$ GP : ACB $\times$ gP : : force of extension : force of compression.

We see from this that the neutral line divides the surface of fracture, so that the parts multiplied by the distances of their centres of gravity from the neutral line, are in a constant ratio.

In the cases of cast and malleable iron, as stated above, the ratio is that of equality, or

$$ADB \times GP = ACB \times gP.$$

If we suppose these products equal in a homogeneous beam of a circular, or rectangular, section, the surfaces ADB and ACB must be equal, that is, the neutral line bisects the section.

Thus much for the means of determining the position of the neutral axis.

If we would consider the total effect produced by the weight W, we should observe that it tends to turn the particles in ADB by tension, about the neutral line AB, and also those in ACB by compression, about the same neutral line. If we suppose the resultant of all the forces of tension to pass through O, the effect of tension around the axis AB will be represented by the sum of the tensions of the particles in ADB multiplied by the distance OP. If, in like manner, we take o for the point through which the resultant of compression passes, the effort to turn about AB by compression will be measured by the sum of the compressions of the particles multiplied by oP. But the weight W acts with the leverage of the length of the beam to the surface of fracture, that is, with oI; whence its effect is measured by W, multiplied by oI. This last effort being equal to the sum of the two former, we have

$$W \times oI = OP \times \text{sum of tensions of particles} + \text{sum of compressions} \times oP.$$

We have before seen that the sum of the forces of tension and of compression on each side of the neutral line, are equal, whence one may be substituted for the other, and our equation becomes,

$$W \times oI = \text{sum of tensions} \times (OP + oP) \text{ or}$$

$$\dagger W \times oI = \text{sum of tensions} \times Oo$$

Whence we see that other things being the same, the weight at H, to produce a given deflection, will depend upon the distance Oo.

In the conditions employed to determine the points O and o, we recognise those for the centre of percussion of a body; accordingly O and o may be found by the rules given for that centre, when the position of the neutral axis has been found.

* Calling the surface ADB $= s$, GP $= g$, ACB $= s'$, gP $= g'$, the ratio of the force necessary to produce extension to that required to produce an equal compression, as $1 : n$; the equation of our author corresponding to the above proportion is $gs = n\,g's'$. This is obtained by a method which we consider less simple than that given above.

In the case of timber, according to Mr. Hodgkinson's experiments, $n = \frac{4}{5}$.

† To find an absolute value for W, call PD $= a$; the weight sustained by the tension of any number of fibres at the top of the beam $= t$. Then since t is the force of tension at the distance a from the neutral line, $\frac{t}{a} \times x$ will be the force at

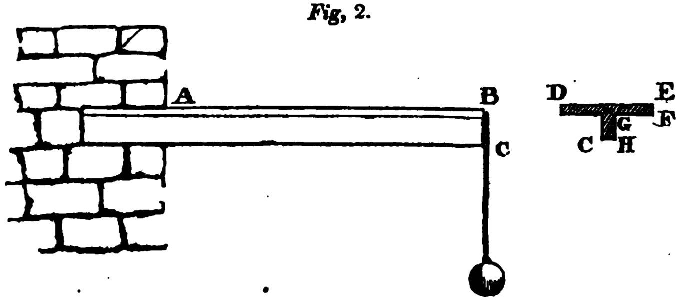
We at once perceive the influence of the form of a beam upon its strength, and that in finding the form of greatest strength we must be guided by the results just obtained. Thus, since the weight to produce a given deflection depends upon the distance Oo, we must seek to remove as far from each other as possible the points O and o, the centres of tension and compression. These points corresponding to the centres of percussion of the two parts into which the section of fracture is divided by the neutral line.

We shall have occasion to refer to these remarks in the sequel. The theory applies so long as the elasticity of the material of which the strength is to be determined, remains unimpaired.

We pass over the very ingenious experimental demonstration of the equality of forces on each side of the neutral line, made by the substitution of springs for the natural elasticity of the particles of solids, and proceed to the author's examination of the relation between the resistance of cast iron to extension and to compression.

"For this purpose, I had several castings moulded of different sizes, but of one general form, such that by bending them, first one way, and then the other, the relative resistances to extension and compression in one and the same part might be obtained. Each casting was several feet long, and equal in section throughout, with its parts as slender as could well be run to preserve it even and sound. During the experiment one end of the casting was fixed in a wall, and weights to bend it hung at the other.

Fig. 2.



any distance x, and that at the mean distance ($GP=g$) will be $\frac{t}{a}\times g$: hence the force of tension of all the particles in ADB ($=s$) will be expressed by $\frac{t}{a}\times g\times s$. Substituting this value in the equation just found, and calling l the length of the beam, we have $wl=\frac{tgs}{a}(p+p'.)$

To comprehend the case in which the beam is bent, the bearing length being altered by deflection l, becomes $l\times$ Cosine of deflection. The formula, calling D the angle of deflection, is $wl\times \text{Cos. D}=\frac{tgs}{a}(p+p'.)$

Both of these equations are from the text, the method only differing from that of the author.

"ABC represents an elevation of the castings, and DCHE a cross section of all of them. The end A was wedged fast into the wall, but so as to be easily removed, in order that the casting might be turned the other side upward; as the intention was alternately to compress and extend the vertical rib of DCHE at C."

Following this method four series of experiments were made, each one consisting of a set with the vertical rib alternately downward and upward. The dimensions of the beams in series one, two, and four, were different; in series two and three nearly the same, having been cast from the same model.

The dimensions of the bar used in the series four are given, to enable the reader to judge of the scale upon which these experiments were made, and because the same dimensions were used in an experiment of a different kind subsequently made.

"Expert. 4.—Length of arm five feet—deflections taken at the end —weights hung at four feet six inches from shoulder—weight of casting at the end with scale $10\frac{1}{2} + 4\frac{1}{2} = 15$ lbs., DE = 4.1 inches, EF = .25, GH = 1.1, CH = .25."

"18. The experiments were mostly begun with the broad part of the casting upwards, to compress the vertical rib; and when a weight or two had been laid on, and the deflections noted, the piece was turned the other way up, before the elasticity was much injured, and the deflections from the same weights again taken, the rib being now extended. This mode of turning the piece, which was usually done two or three times with the same casting, it being first reduced, if necessary to its original form, answered better for obtaining the comparative extensions and compressions by equal weights, than making all the experiments on each side in a series would have done; though it left the tabular results rather more anomalous. I preferred, too, obtaining the extensions and compressions from the same rib, to taking each from different ones, on account of the difficulty of getting such small castings precisely of equal size and equal strength of iron. This mode of making the experiment, however, rendered the time when the elasticity became impaired rather doubtful."

The results are collected in the following table given by the author:—

Expts.	Weights in lbs.	Deflections from extension.	Deflections from compression.	
1st.	7	.37	.34	Earlier weights.
2nd.	30	$.61\frac{1}{2}$	.53	
3d.	30	.96	$.97\frac{1}{2}$	
4th.	30	.86	.84	
1st.	27	1.56	1.35	Later weights.
2nd.	80	1.65	1.63	
3d.	50	1.72	1.67	
4th.	60	2.03	1.86	

"19. With regard to the inferences to be drawn from these experiments, we will make the three following suppositions:—

"1st. Suppose the material to be incompressible, as has generally been assumed in this country, and the experiment to be begun with the back of the casting upwards, the leg GC will, by supposition, offer an insuperable resistance to a force tending to compress it, and the deflection must arise from the small quantity which the broad part DEF will extend: if the casting be then turned the other side upwards, the part DEF being incompressible, the deflection must arise from the extension of GC, and consequently would be many times as great as when the casting was the other side upwards, GC being so much less than DEF.

"2nd. Suppose the body to be inextensible, then if the back of the casting be upwards, the deflection will wholly arise from the compression of GC, and will be many times greater than if GC had been upwards, when it must have arisen from the compression of DEF.

"3d. Suppose the extensions to be equal to the compressions from the same forces; the deflection in this case will be the same from the same force whether the rib GC be downwards or upwards."

"The table of results shows that the first and second suppositions are inadmissible; with regard to the third, it appears that in every instance, except one, the deflections from extension are greater than those from compression by equal forces, whether the elasticity be perfect or not; the first four having been taken before the elasticity could have been much injured, and the last four nearly at the breaking point. Still the difference is not so great, but that they may, in most cases, without material error, be assumed as the same. Hence, the extensions and compressions from equal forces in cast iron, are nearly equal.

"21. This is a very interesting fact: it has often been assumed by writers, but I have not before seen any proof of it, except in an experiment of M. Duleau, which renders it very probable that it is the case in malleable iron. Mr. Tredgold, in his "Essay on the Strength of Cast Iron," has assumed it, and made it the basis of his reasonings. He thence concludes, (Section 4th,) that in a beam of the strongest form, its section ought to have equal ribs at top and bottom of it: so that the neutral axis being at half the height of the beam, there might be equal resisting powers on both sides of that axis. Another conclusion which might be drawn in the same way, and which he mentions, (page 132,) is, that a triangular prism, [he might from his view have said any other form,] is equally strong, whether it be loaded one way up or the opposite, supposing it not strained, so as to injure its elasticity."

[TO BE CONTINUED.]

Improvement in Piano Fortes.

Monsieur Pape has just succeeded in improving the mechanism of the piano forte in a way that merits attention.

It has for some years been acknowledged by skilful practitioners, that if the wires of this instrument could be struck by the hammers from above, instead of from below, that a finer quality of tone, more power, more solidity, and a longer duration as to correctness of intonation would be accomplished. By dint of perseverance and a variety of experiments, Monsieur Pape has triumphed over all his difficulties; and this new piece of mechanism, carried to the highest degree of perfection, is one of the most remarkable improvements in piano fortes that have been invented since the origin of that instrument.

Monsieur Pape, in applying his discovery to horizontal grand pianos, has found the means of considerably diminishing their length, and at the same time of augmenting the volume of tone. The tone of these new horizontal pianos having made it desirable that the same mechanism should be adapted to those of the square form, he made fresh experiments, and the success of them surpassed his expectations; for in reducing his scale to less dimensions than those now in use, not only has he obtained an easier, more nervous, and more delicate touch, but a volume and quality of tone as powerful as in instruments of the ordinary length.*—*Archives des découvertes.*

*** The principle of making the hammer strike the wires from above is by no means a new invention: unless we are greatly mistaken it has been used in Germany many years. That "a finer quality of tone, more *power*, and more solidity" may be obtained by this new application, we can readily conceive; how the principle, however, should affect the "*duration* as well as the correctness of the intonation," we can by no means understand, being ignorant of Monsieur Pape's mechanism.

That with "diminishing the length, he should augment the volume of tone," too, is a very remarkable fact, and which we can scarcely credit without the aid of those two important faculties, the senses of hearing and seeing. As an improvement, however, in an elegant art, it *is* very valuable in every point of view; for we consider this most common of all musical instruments capable of considerable amelioration as to touch, tone, (quality as well as quantity,) and serviceable duration; for of all organs it is the earliest and the most sensibly affected by use and age. *Editor Repertory.*

Improvement in Rail-ways and Carriages at Coal Works.

In this valuable improvement the rail-way is sustained in a level and horizontal position, and at the required height, by a suitable number of upright posts, and permanently secured by bolts or other fixtures. The posts are securely imbedded in the ground, and are preserved in their respective positions by suitable bracings or stancheons. On the horizontal bars which constitute the bed pieces of the rail-way, are beds of wrought or cast iron, or other proper ma-

* See Loud's patent for this improvement in the Franklin Journal, for July, 1827.

terial, which are firmly secured to them, and extend their whole length. These beds are smooth and level to receive the wheels of the carriage, which may be flanched or grooved to move upon them. The rail-carriage consists of a frame, constructed of suitable material, to which axles of wrought iron are attached by means of bolts, or other contrivances. The wheels may be formed of wrought or cast iron, or other proper substance, and may be made solid or otherwise, with their surfaces flanched or grooved to move on corresponding surfaces of the beds of the rail-way. Attached to the bottom of the carriage, and suspended from it, is a chain, which may be lengthened or shortened at pleasure, having a hook at its extremity for attaching a coal tub. At one extremity of the rail-way is a crane, secured by suitable fixtures. This crane is supplied with a chain or rope fall, which raises the coal from the vessel to the carriages, and which may be worked by horse or other power. Beneath the rail-way, and under this crane, is a staying made to slide between the foot, and may be raised or depressed by means of pins or bolts which fit into apertures bored in the posts. The coal is raised to the staying before mentioned in tubs by a chain fall attached to the crane, where it is disengaged by an assistant, and transferred to the carriage. The carriage is put in motion by means of ropes, pulleys, or other machinery, and the coal, suspended in tubs beneath, is transported to the distance required, where it is deposited, the carriage immediately returning with the empty tub. This improved rail-way is of a double form, so as to admit of two carriages moving parallel to each other, when the middle horizontal bed piece has on its surface beds for the inner wheels of both carriages. In this case the crane is placed in the centre, and is enabled to serve each carriage in succession by swinging two ways.—*New Monthly Mag.*

Strength Test for Bleaching Powder.

The necessity of having a means of ascertaining the chlorine strength of bleaching powder has been felt so strongly, that many persons have turned their attention to the discovery of an unexceptionable process for the purpose; and the use of sulphate of indigo, of salts of manganese, and of the chlorometer apparatus of Gay Lussac, is consequently well known to all who are concerned in the use of that chemical production. M. Marozeau, amongst others, has sought to obviate the objections belonging to all the processes known, and has described, as the result of his exertions, a new process founded on the use of mercurial salts. Let muriatic acid be added to a solution of protonitrate of mercury, in quantity more than sufficient to precipitate all the mercury as calomel; then let a solution of chloride of lime be added: the chlorine set at liberty by the excess of acid will react on the calomel, will convert it into corrosive sublimate, which, dissolving, the solution will become perfectly clear and transparent again, if enough chloride of lime has been added.

This effect, when produced by known solutions of mercury and

bleaching powder, and with the attention required to obtain a complete chemical action, is said by M. Marozeau to furnish a very excellent method of ascertaining the strength of bleaching powder; for by agitation of the liquids, all the calomel at first formed may be converted into corrosive sublimate, and dissolved before the slightest odour of chlorine is sensible in the residual liquor. He uses the chlorometer of Gay Lussac, but inverts the office of the pipette or fixed measure of bulk: instead of using it to measure out the bulk of solution of chlorine to be tried, it is employed to measure out a fixed quantity of the test solution of nitrate of mercury, and the graduated jar is used to ascertain the quantity of solution of chloride required to convert the calomel when formed into corrosive sublimate.

The strengths of the solutions of nitrate of mercury and bleaching powder to be tried, are made to conform to the dimensions of the instruments constituting Gay Lussac's chlorometer. The proof liquor is procured by boiling mercury in excess in dilute nitric acid, continuing the ebullition until no deutonitrate remains in solution. The strength is adjusted in two ways, either by preparing a solution of chloride of lime with a known quantity of chlorine, and then trying it against the test solution as yet unadjusted, and diluting the latter until it agrees with this known solution,—or by ascertaining how much of the test liquor is required to precipitate the whole of the chlorine in a known solution of common salt. For, as the quantity of chlorine in common salt required to convert the mercury in a given quantity of test solution into calomel, is exactly equal to that required afterwards from chloride of lime to convert the calomel, so formed, into corrosive sublimate, it is easy to make a known solution of salt, and to dilute the test liquor, until a given quantity of it will exactly precipitate a measure of that saline solution; and such test liquor will, by the process recommended, show what quantity of the solution of bleaching powder contains the same proportion of chlorine as the standard solution of salt thus referred to.

M. Marozeau then gives minute instructions for the use of this process, intended for those who, not possessing much chemical knowledge, still have to apply the instrument; and he states that, having used it very constantly, it has afforded him highly satisfactory results.* [*Jour. Royal Institution.*

Round Sterns to Ships of War.

The important question of round sterns has with much generality been discussed; and it is therefore with no ordinary pleasure that we find a splendid prize has been offered by the French Minister of Marine, for determining among all the forms that can be presented that particular one which shall unite in the highest degree all the requisite conditions that the seaman, the naval architect, and the geometrician may require.

Our readers are aware that a vigorous contest was for a long time

* Ann. de Chim., xlvi. 400.

kept up respecting the *principle* of the round sterns; but time, which softens differences, and moulds even prejudice itself into the form of truth, has, in this case, obtained another victory; and a figure which our gallant seamen had connected with the glorious recollections of Trafalgar and the Nile, is now—with wisdom which cannot be too highly praised—nearly, if not altogether, abandoned. The square stern, with all its massy and cumbrous forms, has indeed given way to another more in unison with the great march of improvement now going on.

But while the principle of what is commonly called the round stern has, with few exceptions, been admitted in all its fulness, its best possible form has not been determined; and it would seem as if fancy, rather than the sound discretion which geometry imparts, had presided over the designs hitherto submitted to the world.

Among the infinite variety of forms which may be denominated "round," there must be one which shall unite in a higher degree than any other, all the best conditions of strength, convenience, and defence;—which shall secure to the brave sailor the greatest degree of comfort, add a new arm to his power in the day of battle, and secure to that portion of the frame work of the vessel, the same admirable strength as distinguishes its other parts. It is this choice of forms, which the French Minister of Marine now invites the naval architect, the sailor, and the man of science, to contemplate; and we hail the call as a revival of the days when the great men of the Academy of Sciences, clad in the armour of the transcendental geometry, descended from the lofty elevation of the system of the world, to contend for the conditions of the metacentre, the great principles of stowage, the problems of masting, of pitching, and of rolling, and all the other complicated but interesting inquiries, which the general question of ship-building involves.

Our *Journal*, read alike by geometricians, the naval architect, and the sailor, can hardly be better employed than in recording the conditions which the French minister has proposed for this great problem.

"To furnish the best plans for the circular sterns for line of battle ships and frigates, with all the exterior and interior fittings, the manner of disposing the timbering so as to combine the necessary conditions for defence, with strength, lightness, a dispersion of the weight in proper proportion to the displacement of each part, the efficiency of the rudder, the convenience of the water-closets, and the general suitableness of the accommodations.

"This manner of fitting the stern must possess facilities for enabling the commandant to be aware of whatever manœuvres may be in progress, without being obliged to appear on deck.

"The style of ornament which it would be proper to adopt, as well for the forward as for the after part of these new constructions, is also to be described. The competitors are to remember that nothing of importance is to be at all sacrificed to these decorations.

"The side of the ship at the stern must have the same thickness as at the corresponding places in other parts of the ship. The ports must be so disposed, that it may be easy, on each deck, to bring guns

to bear right aft, and on the angles of the quarters, to command those points which the other guns cannot be brought to bear upon.

"The rudder may be fitted either without board or within with a circular head, but reasons must be given for whatever plan may be proposed. Reasons also are to be stated for the station which may be proposed for the water closets, whether they are fitted interiorly, or in an exterior gallery.

"The officers of the different branches of the naval service are called upon to send their proposals to the minister before the 1st of July, 1832. Other persons wishing to become competitors, are eligible to do so.

"The memoir in which each competitor explains his proposals, must be accompanied with all the calculations and drawings which may be necessary to render his plan perfectly complete and intelligible in all its details.

"Each proposal must have a motto affixed to it, of which a copy is to be enclosed in a sealed letter, containing also the name and place of residence of the proposer.

"A medal of the value of 2000 francs will be given to the author of the best memoir presented to the minister of marine before the stated period. [*Brewster's Jour.*

On Artesian, or overflowing, Wells, and the employment of the Warm Water brought from great depths for economical purposes.

From the Edinburgh New Philosophical Journal.

Whence do artesian wells derive their water, and how do they acquire their power of ascension, which sometimes occasions in the middle of plains, at a distance from hills and mountains, the surprising phenomenon of spouting springs? are questions which have been often proposed, and very variously answered. The most natural explanation is undoubtedly that which supposes the water of these wells, like that of natural wells, to be derived from the atmosphere, and their power of ascension the hydrostatic pressure of a more elevated reservoir, with which the perforated canal or bore stands in connexion. Sometimes, however, the local relations are such that it is difficult to refer the water to such a source, and then it is that the framers of wild hypotheses stand forth with their absurdities. A late observation, which affords a striking proof of the accuracy of the above explanation, is therefore the more worthy of being noticed.

At Tours, on the Loire, an artesian well, with a bore of three and three-quarter inches, which brought the water from a depth of 335 feet to the surface, was damaged, and they were obliged, (on the 30th of January of this present year,) to remove the tube till within twelve feet of the surface. The water suddenly rushed out, increased fully to a third more than its former quantity, and continued to flow for several hours. It was now no longer clear as before; on the contrary, it brought along with it a great quantity of fine sand, and

surprising enough, also numerous remains of plants and bivalve shells; branches of the thorn several inches long, and blackened, owing to their residence in the water; further, fresh stems and roots of marsh plants, seeds of many different plants, and also fresh water shells, as *Planorbis marginatus*, also *Helix rotundata*, and *Helix striata*. All these resembled those which are found after floods, on the sides of smaller rivers and brooks. The fact is so remarkable, that the truth of it might be called in question, had it not been accurately determined. There result from it the following conclusions:

1. The water of the artesian well of the city of Tours must occupy not more than four months in flowing through its subterranean canals, because the ripe seeds of harvest have reached the mouth of the well without being decomposed.

2. As the water carries along with it shells and pieces of wood, it cannot reach its place by filtration through the layers of sand, but must have flowed through more or less irregular canals.

3. The source of this water is to be looked for in some moist valleys of Auvergne and the Vivarais.

The remains of the plants and animals are deposited in the mineral cabinet of the city. As soon as the seeds, five or six in number, are referred to their plants, naturalists will, in places situated higher than the basin of the Loire, be able to make out the points where these subterranean waters are poured out.

It is to be wished that French observers would state how they prove that the waters of this well come from Auvergne, about 130 miles distant. If this shall be proved, the considerable rise of artesian water in other places, where no hills occur near, or where they are bored in the most elevated points in the neighbourhood, will lose every thing puzzling.

This rising is sufficiently remarkable to induce us to communicate some examples from Hericart.

Name of the Well.	Depth of the well from the surface of the place.	Height of the rise above the level of the Seine, at the Point de la Tournelle.
	Paris feet.	Paris feet.
St. Owen	150.8	6.2
Same	203.2	11.1
Epinay	166.2	24.6
Same	207.8	33.8
Maison Blanche near Paris	121.6	64.6
Mount Rouge at Paris	315.5	80.0

The two last wells, exactly those which rise highest above the level of the Seine, are bored on heights, and hence their water remains considerably under the surface of the earth; also in both the

deepest of the bore-holes is still above the level of the Seine, in the first seven metres, in the last about one metre.

In the work of Hericart, a fact is mentioned, which confirms the view of artesian wells already given. Gulfs, in which rivers and rivulets lose themselves, are very frequent in the Jura, and other similar limestone mountains, and there, where the uppermost bed consists of a clayey soil, which opposes the sinking down of the rain, sometimes proves very beneficial in agricultural operations, by carrying away the superfluous water. In some places, M. Hericart remarks, man has imitated this example set by nature with great effect. The draining of the plain of Palans, near to Marseilles, is an example of *this*. This plain, which is at present covered with beautiful vineyards, was formerly a great marshy basin, without outlet. It was drained by means of great sink holes, which were sunk down to the underlaying porous or cavernous stone, and were connected together by means of a number of ditches or drains. The water which was carried away by these shafts, reached, by means of subterranean canals, the harbours of Mion, near to Cassis, where it appeared again as spouting springs. Here, therefore, man, without intending it, made artesian wells, not for the purpose of obtaining water, but in order to get *clear of it*.

The following report, published by M. Bruckmann Kongl, Wurtemburg Baurath, in the *Ver handlungen zur Beforderung des Gewerbfleisses in Preussen*, 1830, Lieferung, No. 4, affords a striking proof how varied the uses are of artesian wells. M. Bruckmann caused to be bored, under his inspection, from August 1827, to December 1829, at Heilbronn, five bore holes for fresh water, in order to obtain the necessary quantity of pure water for the purposes of two paper mills and a flax spinning mill. Two of the bore holes were sunk to a depth of sixty feet, one to ninety, another to 100 feet, and one to 112 feet under the lowest level of the Neckar. In all of them the water rose eight feet above the level of the Neckar, and on an average each delivered from forty to fifty cubic feet. The purpose of the borings was perfectly accomplished, even to overflow; but the discovery was made that the water of all the bore holes had constantly a temperature of 54.5 Fah. This fact led M. Bruckmann to a very important application of this water, viz. heating the mills with it. The paper mill contained 72,000 cubic feet, a working hall over it 10,800 cubic feet. Both spaces, which contained together 82,800 cubic feet, were the whole winter, 1829–1830, through, warmed by this water alone to a temperature of 45°.5 Fah. and 47°.7 Fah. and when without, the temperature was 24.2 Fah. The thermometer in the mills did not sink lower than 41° Fah. even when the doors were kept open. Every miller knows well how much labour, time and expense it occasions in hard winters to heat daily, and even in a scanty manner, the water wheels, and with what risk of life it is attended. It was reserved for Mr. Bruckmann, by means of artesian water, to free his water mills from this burdensome evil. He conducted the running water from the Hollander, which still possessed a temperature of 52°.2 Fah., through tubes into the Wassergasse, and had thus

the satisfaction to find that his water wheels, the whole winter through, even when the external temperature was as low as 24°.2 Fah. never froze.*—*Poggendorf's Annalen, H. ii.* 1831.

Meteorological Observations for February, 1832.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches.				Inches.	
⊗	1	25°	33°	30.15	30.25	26	W. SE.	Moderate.		Clear day.
	2	34	44	30.04	30.00	36	SW.	do.		Cloudy day.
	3	40	56	30.00	30.00	47	SW.	do.		Clear—cloudy.
	4	48	44	30.24	30.24	42	NW. NE.	do.		Cloudy day.
	5	32	32	30.10	29.30	25	NE. NW.	do.	.75	Rain—snow.
	6	21	30	29.30	30.20	10	NE. E.	do.		Clear—cloudy.
	7	29	39	29.90	30.00	13	W. NE.	do.		Cloudy day.
	8	26	29	30.20	30.20	26	SE .E.	do.	.90	Sleet and snow.
☽	9	23	32	30.00	29.85	27	SE.	do.	.60	Cloudy—rain.
	10	32	32	29.90	30.10	29	W.	do.		Cloudy—trees loaded with
	11	28	32	30.25	30.20	38	SE.	do.		Clear—cloudy [ice.
	12	45	56	29.70	30.60	54	S.	Blustering.	.11	Rain in the night.
	13	34	35	30.00	30.10	19	W.	do.	.20	Cloudy—rain.
	14	30	36	30.30	30 30	27	SE.	Moderate.		Flying clouds—clear.
☺	15	32	42	30.20	30.30	37	W.	do.	.5	Snow—flying clouds.
	16	29	32	30.40	29.84	24	SW.	do.		Drizzle—fly'g cl'ds. rain &
	17	16	26	29.90	29.80	11	W.	do.	.20	Cloudy day. [snow at nt.
	18	36	54	29.80	29.70	45	SW. W.	do.		Cloudy day.
	19	49	65	29.60	29.55	54	SW.	do.		Clear—cloudy.
	20	50	40	29.55	29.55	40	N.NW.	do.		Cloudy—flying clouds.
	21	19	22	29.80	29.94	9	W.	Blustering.	.56	Cloudy day.
	22	16	34	30.30	30.40	14	SW.	Moderate.	.19	Rain—cloudy—snow in
☾	23	42	42	30.20	30.10	32	SW.	do.		Clear day [the night.
	24	8	13	30.44	30.50	5	W. N.	do.		Clear day.
	25	19	30	30.33	30.10	26	E. N.	do.	.13	Cloudy day—snow in the
	26	31	35	30.00	30.00	30	N. W	do.		Cloudy—clear. [night.
	27	26	45	30.10	30.13	16	NW. SE.	do.	.20	Cloudy—rain—sleet.
	28	32	40	29.90	29.80	35	SE.	do.		Cloudy—rain.
	29	43	43	29.90	30.00	33	W.	do.	.30	Cloudy—rain.
										Rain—cloudy.
										Fog—clear
	Mean	30.86	36.65	30.01	30.03	28.62			4.19	

	Thermometer.	Barometer.
Maximum height during the month,	65. on 19th.	30.60 on 12th.
Minimum do.	8. on 24th.	29.30 on 5th and 6th.
Mean do.	33.75	30.02

* The period will come when we shall be forced to look out for a substitute for coal. If when that time arrives, no new means of procuring heat economically shall be discovered, we may be able to draw from the great subterranean depository of caloric, and partly by means of the subterranean waters, heat for our various wants.

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

APRIL, 1832.

An examination of Mr. Espy's remarks relative to the application of water upon the wheels at Fair Mount Water Works.

TO THE COMMITTEE OF PUBLICATION OF THE FRANKLIN INSTITUTE.

Gentlemen,—At page 73 of the current volume of the Journal of the Franklin Institute, I find Mr. J. P. Espy's remarks on an article which appeared in the fourth volume of the Franklin Journal, over the signature "L. M." I have only seen as much of the latter article as is quoted by Mr. Espy. Upon this he remarks, "Upon reading that part of the essay which relates to our works at Fair Mount, I was surprised to find a disparity between the power and the effect so great as three to one." And again he says, "the writer has also estimated too high the retarding influence of the inertia of the water put in motion by the buckets with a velocity equal to the difference of the velocity of the bucket, which is twelve feet, and the velocity of the water in the direction of the circumference of the wheel. This difference, on the supposition that the water comes on the wheel one foot from the surface, at an angle of forty-five degrees, is six and one-third feet."

The whole loss of power is estimated by "L. M." thus—"The velocity of the water in the required direction is that which is due to a fall of five and two-thirds inches.

"Immediately on striking the wheel it receives a velocity due to a fall of twenty-seven inches.

"The difference indicates the power expended by the wheel in giving it that velocity, - - 21½ inches

"The water comes on the wheel below the surface of the dam, - - 12 inches

"Total loss, - - 33½ "

Mr. Espy then says, "It appears to me that the following method of calculating is the true one—

"The velocity of the water in the required direction is five and a half feet; immediately on striking the wheel it receives an additional velocity of six and a half feet, due to a head of 8 inches

"The water comes on the wheel below the surface of the dam, - - - 12 inches

"Total loss, - - 20 inches."

From the foregoing statements, Mr. Espy arrives at (what I conceive to be) the erroneous conclusion, that water let on to a wheel, at a less velocity than that of the wheel itself, will give a maximum effect.

It appears to me that "L. M." has erred in supposing that water in motion at a velocity due to one foot head, viz. eight feet per second, at an angle of forty-five degrees, to the direction of the wheel, would oppose a resistance to the buckets, by the influence of its inertia, proportioned to the difference between the velocity of the wheel, and that of the water in the *direction of the wheel*, to wit, six and a half feet. This error is obvious from the fact, that the water strikes the soaling of the wheel at an angle of forty-five degrees, by which its motion, instead of being destroyed, is only changed to the direction of the wheel's motion; hence, all that can be lost by this change of direction is, what may be occasioned by the agitation of the water, and therefore it moves in the direction of the wheel at a velocity but little less than eight feet per second. If no part of the water should reach the soaling, and have its direction changed before the bucket had urged its velocity to twelve feet, "L. M.'s" statements would be correct.

Mr. Espy first sanctions "L. M.'s" error in relation to the action of the first motion of the water, by supposing it to receive from the bucket an additional motion of six and a half feet, when, in fact, it receives from that source but little more than four feet per second. Next he falls into the greater error, of *first principles*, to which, if he goes back, he will find that, when water is falling, or moving, at the rate of five and a half feet per second, a power equal to a head of eight inches will not increase its velocity six and a half feet, or raise it from five and a half to twelve feet per second, any more than the velocity of a heavy body could be increased from thirty-two to sixty-four feet by the same quantity of power that gave it the first motion of thirty-two feet.

By the recollection "that water produces a greater mechanical effect by gravity than by impulse, the paradox will" *not* "vanish;" for it follows as a corollary, that if water cannot communicate its

whole power by impulse, it cannot receive the *whole* of any expended power by the same action.

I will here leave the subject for the present with the fullest confidence that Mr. Espy will at once see the error into which he has inadvertently fallen, and that he will as promptly correct it.

I feet confident also that he will perceive that no calculation, founded on sound principles, can lead to a conclusion that any velocity of the water, less than that of the wheel, can give a maximum effect.

As this subject has reference to our important works at Fair Mount, where the most economical use of water may *soon* be much more important than it is at present, any suggestions tending to improvement in this department of the works, may not be considered premature at this time. From the foregoing, it appears that in the present arrangement, twenty-seven inches, or more than twenty-eight per cent. of the head is lost by reason of the high velocity of twelve feet per second, at which this arrangement requires that the wheel should run: to which is added the loss sustained by the oblique direction of the water to a tangent to the wheel at the point of application, as noted above. To obviate most of the loss thus sustained, I will suggest a modification of the present arrangement, as follows: In place of the wheels now in use, the largest of which I believe is eighteen feet, I would apply three wheels of seven feet diameter each, for which I believe there is ample room. To these I would apply the water by what is termed the *pitchback overshot* principle, and drive them four and two-thirds feet per second, at which rate the same number of revolutions will be made as with the present wheels at twelve feet per second. The combined velocity of the three wheels will be fourteen feet, and will be competent to do more work than one wheel moving twelve feet in the proportion of fourteen to twelve, and will permit the stroke of the pump to be increased in the same ratio. With a velocity of four and two-thirds feet in the wheels, the effect of the water by *impulse* under a head of one foot, will be equal, nearly, to half the effect of the same quantity acting by gravity; hence, the whole loss of head will be but a fraction more than six inches, instead of more than twenty-seven inches, by the present arrangement. These wheels may be connected with each other by segments on their peripheries, or, by the simple and cheap application of two connecting rods. Each of these may connect the crank of an outside wheel to the common crank of the centre wheel, and this last may be connected with the pump on the present plan. These three wheels, with their connexions, will weigh, and cost, but little more than one wheel of eighteen feet diameter, and the frictions will be but little increased.

Very respectfully, yours,

C.

FRANKLIN INSTITUTE.

Reports of the Committee on Inventions.

The committee on inventions, appointed by the Franklin Institute, for the promotion of the mechanic arts, to whom was referred the consideration of the several subjects annexed, present the following reports, viz.—

On James Spicer's plan for Transporting the Mail, &c.

Mr. Spicer proposes to transport the mail, &c. between any two given points by the following arrangement. Tubes (of wood or metal) of uniform bore, are to be placed horizontally, and in a direct line between the two points; within these tubes the mail is to be moved. To effect this motion the mail is to be attached to an air-tight plug, moved by condensing the air upon one side of the plug, and rarifying it upon the opposite side. Mr. Spicer proposes to divide the distance between any two large towns, (as, for example, between Philadelphia and New York,) into sections of five miles each; an engine for condensing, (or exhausting,) being placed at one end of the section, while another for exhausting, (or condensing,) is placed at the opposite end. It is understood that it is proposed to use tubes ten inches in diameter.

To examine this device the first inquiry should be directed to ascertaining whether it is good or bad in theory, and if good in theory it would then remain to examine whether it is practically good, and finally, to estimate the cost of its application as compared with other modes of conveyance, as by rail-roads, &c.

The first question, in point of magnitude, in the theoretical examination of this machine is, do the known laws of the motion of elastic fluids, warrant us in concluding that air can be compressed and exhausted in the manner proposed? That air has inertia is proved by the familiar illustrations of its force when in motion, and its resistance, when at rest, to a body moving throught it. That air in passing through a tube would be retarded by friction is reasonable to suppose from the laws which apply to other fluids. To determine the amount of this resistance recourse must be had to experiment, from which alone, the data for correctly solving such problems can be obtained.

Many experiments have been made upon this subject, possessing various degrees of merit.* In an experiment made in England, by Wilkinson, the whole force of a large hydraulic wheel could not force air to the distance of 320 yards through a pipe one foot in diameter. Girard found that a pipe of .6 of an inch in diameter, and 364 feet long, diminished the discharge of air by .9. Other experimenters have made the expense due to resistance in passing through tubes, less; as those of Clement Desormes, in which a loss of thirty-

* Annales des Mines, vol. ii. D'Aubuisson sur les Machines Soufflantes à Piston.

five per cent. was produced in a pipe ten inches in diameter, and 1490 feet in length.

D'Aubuisson in an elaborate series of experiments,* made at the mines of Rancié, has investigated the amount of resistance experienced by air in passing through tubes of various lengths and diameters. The diameters experimented upon, were four inches, two inches, and one inch. The length from twenty yards up to 430 yards, (nearly one-fourth of a mile,) varying by lengths of twenty yards. The force of the air at the different points was measured by syphon gauges at opposite ends of any pipe; the difference in height of the two gauges measuring the force expended in overcoming the resistance of the air to motion through the pipe. From these experiments results a formula by which, having given the pressure of the air at one extremity of a tube, in inches of mercury, the diameters of the tube at the two extremities, the length of the tube, the height of the barometer which measures the pressure of the external air, and the temperature of the air, the pressure at the opposite end of the pipe may be found.

For the purposes of our examination, we may assume the air at 32° Fah. (0° of centigrade scale,) and neglect the effect of the increase of temperature by condensation, and its decrease by rarifaction. The diameter of the tube is also to be taken the same throughout, viz. ten inches. The height of the barometer is assumed at thirty inches. With these data the following table has been calculated from the formula, assuming that at one end of the tube there is placed a steam engine capable of effecting a condensation equal to eleven atmospheres. The first three columns give the lengths of the tube in different denominations, the fourth shows the effect at the end of this tube in terms of inches of mercury, as shown by a gauge at that point; the fifth the total elastic force of the air at the several distances, and the sixth the ratio of the compression at the two extremities, or the ratio of effect produced to force expended.

Condensation at the beginning of the tube 330 inches of mercury, or eleven atmospheres.	Miles	Feet.	Inches.	Effect in inches of mercury.	Total pressure at the several distances.	Ratio of total pressure to force expended.
	0			300.0	330.	1.
		20	240	287.2	317.2	.961
	⅛	660	7,920	118.1	148.1	.449
	½		31,680	58.6	88.6	.267
	1		63,360	37.7	67.7	.205
	2		126,720	23.4	53.4	.162
	2½		158,400	19.7	49.7	.150
	3		190,080	17.5	47.5	.144
	4		253,440	14.0	44.0	.133
	5		316,800	11.6	41.6	.126

* D'Aubuisson, sur la Résistance de l'Air dans les tuyaux de Conduite. Annales des Mines, 2nd series, vol. iii. 1828.

We see by the table just given, that in a tube of only one-eighth of a mile in length, about five-tenths of the power applied is consumed in overcoming the resistance to the motion of air through the tube; that at a distance of half a mile seventy-three per cent. of the power applied is expended in the same way, and that at two and a half miles there remains as an effective propelling force, but fifteen per cent. of the whole power applied. Exhibiting a consumption of power which puts out of the question the adoption of such a plan. By similar means, the effect of exhaustion at the opposite end of the tube might be calculated, and since the same sources of resistance exist in this case as in the other, the conclusion can but be of a similar kind. The foregoing table shows that in a tube of twenty feet in length, the resistance would be altogether inconsiderable, and hence, in the model of Mr. Spicer, eighteen feet long, notwithstanding its small diameter, he was not enabled to detect any resistance which would have led to an abandonment of his plan. The committee can but regret that expenses should have been incurred by Mr. Spicer in bringing his invention before the public, which they understand he is ill able to afford.

The committee have hitherto considered this subject without reference to the question of its novelty, because they wished that the question of theory might be fairly met, and because they believe the idea to be original with Mr. Spicer, and therefore the credit of whatever ingenuity may be perceived in it, to be his due. In justice, however, to themselves and to the public, they must state that a patent was taken out in England in 1824, for a project in some sort similar to this. This patent which bears date February 19, 1824, was granted to John Vallance, of Brighton, "for producing locomotion by stationary engines." The design of the patentee was as follows: an air tight tunnel, of about eleven feet in diameter was to be provided, within which, upon a rail-way, carrriages for the transportation of goods and passengers, were to move: these carriages were to be attached to a shield fitting air-tight within the tunnel, and motion to be communicated to the shield by exhausting the air in front of it by an engine stationed at the end of the tunnel towards which the shield was to be moved; the pressure of the atmosphere upon the opposite side of the shield would thus be the propelling force.

The plan of Mr. Spicer differs from this in being upon a much smaller scale, and for a more limited object, which is decidedly in its favour when compared with the other. A further difference is to be found in his use of the compression of air, as well as of its exhaustion.

On Franklin Peale's Moveable Diagrams for illustrating the construction of the Steam Engine.

The moveable diagrams submitted by Mr. Peale to the examination of the committee, are three in number, the first illustrative of

the locomotive engine, the second of the ordinary low pressure engine, the third exhibiting the mode of operation of the trunk valve and of the forcing pump of the engine.

The first diagram is a longitudinal section and front view of the locomotive engine, exhibiting the structure of the boiler, its connexion with the cylinder, the transference of the motion of the pisten rod to the wheels of the locomotive carriage, with the more important details belonging to the engine and carriage. The diagram is of pasteboard, neatly and perspicuously coloured. The parts to which motion is to be communicated, in the working of the engine, are formed of separate pieces of pasteboard, attached to each other by means which permit motion; each piece having the place which the part represented by it would occupy in a working engine: the assemblage thus composes an accurate representation of the machine, in which each part is free to take the motions which it really has in practice. Hence, while we are admitted to a full view of the interior of the machine, as by a faithful drawing, we see at the same time, and may study, the working of all the parts, as from a transparent model. In the diagram described, motion being communicated by the hand to one of the wheels of the carriage, the piston of the engine is seen to rise and fall; this motion seems to be transferred to the wheels, upon the axle of one of which an eccentric moves, giving play to the slide valve, thus seeming to continue motion to the piston by alternately admitting the steam from the boiler above and below the piston, and allowing its escape at corresponding periods from the opposite sides; the forcing pump by which the boiler is supplied with water, also is seen in action.

The second diagram is a highly finished representation of the low pressure engine, in which are clearly shown the communication of motion from the piston rod to the working beam, thence to the crank, the action of the fly wheel, of the eccentric in working the valves, of the cold and hot water pumps, and of the air pump; the engine may thus be studied in any of its working positions, and the relations of the parts in any one of these positions distinctly shown.

The third diagram is supplementary to the others, exhibiting in detail the wörking of the trunk valve, in its connexion with the cylinder, and with the positions of the piston, and also the working of the air pump; the valves of the pump are made to rise and fall alternately by a simple arrangement behind the diagram, and connected with the motion of the pump rod, so that the induction valve opens, as in practice, on the ascent of the piston, whilst the eduction valve closes, and vice versa, on the descent of the piston.

These moveable diagrams combine two qualities rarely united in the same apparatus. While they give a perfect representation of the machines to be illustrated, and therefore afford as elevated a means of demonstration as can be adopted, they furnish at the same time the most simple and pleasing method of exhibition; they are, *in other words*, equally valuable instruments for scientific or for *popular* illustration.

The committee give to this design their unqualified approbation.

On Charles Goodyear's Spring and Lever Fauset.

The committee are of opinion that Mr. Goodyear's spring and lever fauset is good in principle; the valve which closes the aperture being pressed down by means of a spiral spring, and in addition thereto, the pressure of the fluid contained in the vessel assists in making it tight; it is opened by means of a small lever, and in consequence of the valve not being subjected to friction, will not be liable to get out of repair. If properly made, the committee believe that these fausets will be superior to any other kind now in use.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN OCTOBER, 1831.

With Remarks and Exemplifications, by the Editor.

1. For *Beds with elastic steel springs of coiled wire;* Alonzo G. Hull, city of New York, October 1.

This bed is intended principally for the use of invalids, but it is said that it will be found very acceptable to others; the construction of the bed is very complex, as its whole surface is to be formed of separate cushions, which are cubes of three or four inches. Each of these cushions is to be sustained by a spiral spring, placed vertically, about an inch in diameter and six inches long. To connect the whole a sort of coat of mail is to be made of sheet iron, or other metal, by loosely uniting together quadrangular plates of three, or more, inches square; this may be effected by punching four holes in each plate, one on each side, at equal distances from its angles, and connecting together by rings a sufficient number of them to give the desired surface. One of the cubical cushions is to be fastened on each of these plates, and the springs are to bear against their under sides.

There is to be a floor, or platform of wood, in the usual place of the sacking bottom. This floor is to be in three parts, in order that the head portion of the bed may be raised, and the foot portion depressed, which is to be done by means of pulleys, in the manner of other invalid bedsteads. The lower ends of the springs are to be attached to the floor in a peculiar way, in order to allow of the raising of any particular part, or section, of the bed, according to the state and requirements of the patient. We shall not attempt to describe this contrivance, or several other auxiliary appendages. This method of raising any part of the bed is, however, a principal point in the claim of the patentee.

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2. For a *Machine for planting Corn and other seeds;* Henry Todd, Pembroke, Merrimack county, New Hampshire, October 1.

In the planting machine here described, there is a round box to contain the seed, which box is fixed upon a suitable platform, and in this platform there is a hole to allow the seed to pass. Within the

box, and resting on the platform, is a revolving bottom, which fills the whole diameter of the box; and in which there are two, three, or more holes, at regular distances, that coincide with those in the platform, so that the seeds may be dropped as they pass over it. A wheel pressing on the ground and having a bevil gear, gives motion to the revolving bottom. This apparatus, it is said, may be attached to a common plough, or, in preference, to one made for the purpose. The claim is to "the principle, application, and operation of said machine." There is nothing new in the *principle*, as it has been frequently used; and the patentee, therefore, could only be entitled to his own particular mode of applying it.

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3. For a *Cooking Stove;* Samuel Beals, Boston, Massachusetts, October 1.

The patentee observes, in the commencement of his specification, that he does not claim any thing new in the particular parts, but only in the general arrangement of his stove, which is intended for the burning of anthracite, or other fuel.

The body of the stove is, we suppose, to be made of cast iron; it has an open front, somewhat like that of an open, or Franklin, stove. There is a grate at bottom, but no bars in front, the furnace part being sunken, and lined all round with fire brick. There is, of course, an ash pit, to admit a draft of air under the coals. There are holes through the top for boilers; and a crane on which to hang a kettle is affixed to one side. The flue is at the back, and steam pipes from the kettles lead into this flue. An apparatus much like the common tin kitchen is used for baking, or roasting, and is so made as to fit into, and entirely to close, the open front. Doors open at the back of this apparatus, to admit of the necessary attentions of the cook.

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4. For a *Secret Bedstead for sofas and settees;* Williams Woolley, city of New York, October 3.

In the specification now before us, Mr. Woolley refers to a patent which he formerly obtained for bedsteads, observing that "the ground of the principle is the same" in the present instance. The bedstead, it is said, may be either extended from the front, or the back, or drawn out from the top of the sofa; the seat and cushion, in the latter case, forming a part of the bedstead.

Bedsteads constructed in the way proposed by the patentee, were common in former days, having been made to fold up into the appearance of common settees, sofas, bureaus, and other articles of furniture. The seat of a sofa, upon one of the plans proposed, is to rise upon hinges against the back; the bedstead, which is folded in joints beneath it, is to be drawn out, the sofa seat closed down, and the bedstead is thus made ready for use. What there is of a new principle in this contrivance, the patentee does not say, as his specification merely describes his modes of construction, without claiming any particular part.

The principal objection to bedsteads of this description is the diffi-

culty of keeping them clean; there are in the different joints so many hiding places for vermin, as in this particular to set the utmost industry at defiance.

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5. For a *Plough;* William Black, Anne Arundel county, Maryland, October 4.

The improvement claimed is the fixing a cutter, or coulter, upon the front edge of the mould board, by means of screws and bolts. The front, or cutting edge of this appendage is to be in the form of a segment of a circle, convex outwards.

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6. For a *Machine for washing Gold out of sand and pounded ore;* Christopher Bechtler, Rutherford county, North Carolina, October 5. Issued under a special Act of Congress, the patentee being an alien.

An iron bowl is to receive the earth to be washed. This bowl is made with a flat bottom, and a vertical rim, presenting the form of a common seive. At one side of it there is a spout to allow water and sand to run off. The bowl is suspended from a piece of timber, like the dish of a pair of scales; the material to be washed is to be put into it, water also being allowed to run in to a proper height, the washing is to be effected by agitating the bowl in a particular way; the method of effecting this is the main point claimed, and is as follows:

Upon a flat table, or bench, there is to be fixed a band wheel, with a handle to turn it horizontally; the band from this wheel turns a small whirl just under the centre of the bowl, and a pin, placed a little out of the centre of the whirl projects up from it and passes into a hole under the centre of the basin; when turned, therefore, it keeps the bowl in agitation. Six bowls may be thus operated upon by one man, and the patentee says that one bowl will wash more than any other machine now in use, and that the most minute particles will be collected by it.

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7. For a *Machine for washing Gold out of sand and gravel;* Christopher Bechtler, Rutherford county, North Carolina, October 5. Issued under a special Act of Congress, the patentee being an alien.

This machine has a hopper at top into which the earth is to be thrown by one hand, whilst another is employed in turning a crank to keep the moving parts of the machine in operation; these consist of a pump, a seive, and a rocking trough. The pump is to raise water enough to supply the hopper; from this the earth and water fall down upon a seive which is kept in agitation, and placed in a sloping position, which causes the larger stones to roll clear off, whilst the gold, &c. passes through the seive. From the seive it passes on to a concave rocker, standing a little inclined, and having a ledge in front to detain the heavier pieces of gold. The lighter

particles flow with the water over the ledge, and fall upon a coarse cloth which is to collect them.

This machine, the patentee says, loses none of the metal, whilst all others lose from one-fourth to one-half.

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8. For an improvement in the *Guitar;* E. N. Scherr, city of Philadelphia, October 6.

The patentee calls this instrument the 'Harp Guitar,' and claims nothing peculiar in its construction, other than giving to it greater length than usual, so that its end may rest upon the floor, instead of being held in the hands or on the lap, as is usually done. In other respects it may assume all the varied forms of the guitar; "the improvement is, that the harp guitar is played resting on the floor."

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9. For a *Churn;* Amon Bailey, Poultney, Rutland county, Vermont, October 6.

A box is to be made in the form of the key stone of an arch, inverted. Through slots in the top of this pass the ends, or handles, of two vibrating dashers, which are to have slats upon their ends within the box; these slats are so arranged that they will pass each other. "The performer moves the handles of the dashers at the same time, in opposite directions, until the process is ended."

This improved churn will, we apprehend, exact a very awkward kind of action from the *performer.* There are many churns in which the cream is agitated much in the same way, but by more convenient appendages.

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10. For a *Machine for cleaning Chimneys;* Thomas Hinkley, Hallowell, Kennebeck county, Maine, October 7.

In its general construction this machine resembles many others which have been contrived for the same purpose, and some of which have answered very well in certain chimneys, although no one has yet been invented which can be used generally; nor, in the present state of affairs, is this to be anticipated. Chimneys are built according to the suggestions of the ignorance, intelligence, fancy, or caprice, of the bricklayer, without rule or plan; in the same flue they vary greatly in size, and are sometimes as tortuous as whim, accident, or genius could make them; and although fire or a climbing boy may be able to find their way along them, and operate upon all their sides and angles, it will require some universal genius to contrive a machine which shall be able so to do.

In the present machine there are four elastic arms, made of iron or steel, with brushes, or scrapers, as the case may be, attached to their ends, the arms being adjustable by means of segments of circles and thumb screws, placed near their junction at the lower part of the machine. When used a weight may be hooked on to the bottom, and a rope attached to the top of the machine.

The points claimed are "the adjusting arcs, with screws to regulate and fix the arms for the brushes and scrapers; the action of the

screws by which they press constantly against the side of the chimney; and the mode of adjusting the scrapers and brushes upon the arms, according to the dimensions of the chimney."

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11. For a mode of *Applying High Steam, and Hydrogen Gas, to aid in producing Combustion in the use of Anthracite Coal;* Paul Chase, city of New York, October 7.

The principal object aimed at by the patentee, is to supply a portion of hydrogen gas, obtained by the decomposition of water, to aid the combustion of anthracite in the furnaces of steam engines. In the arrangement described and figured, there are circular bellows, worked by a rod from the lever beam, to assist in supplying atmospheric air; this air is conducted by a pipe into a tube, or retort, of iron, which is placed across the fire place immediately under the bars of the grate. This tube, or retort, has holes in its upper side, to allow air and steam to escape into the furnace, between each of the grate bars. The steam which is to accompany the air is to be generated from water furnished through another tube connected with a reservoir of that fluid, the supply being kept up by a force pump. The proportion of water to that of air is to be as twenty to eighty.

When the air and water escape into the furnace, they do so, according to the statement of the patentee, in the form of "hydrogen gas, or high steam," which gas, or high steam, is to be taken up by the draft into the body of ignited coal, and cause a flame to extend throughout the fire-place and flues.

The patentee, it appears, filed a description of his invention in the patent office in March, 1828; the proposition to aid the combustion of anthracite by means of steam, is, however, of older date than this; yet we infer that this is the only thing intended to be patented. We say infer, because we are not clearly informed in any part of the specification, what is meant to be claimed as new. The drawing referred to in the description is very well executed, and the instrument has been carefully written, still it gives no instruction respecting several important points, and more particularly that of the claim.

There is mention made of water pans, which have rods of iron in them, to operate by the motion of a boat, and agitate the water in aid of the action of the above described tubes; this is all we hear respecting them.

As regards the theory, the truth of which is so generally taken for granted, that because the flame from burning fuel is expanded, or rendered diffusive by the action of steam, the water must be decomposed into its elements, oxygen and hydrogen, we have never admitted it as true. This is not the place to discuss such a subject, but it will be at once apparent to every one acquainted with chemistry, that such a decomposition of water must be simultaneously, or instantaneously, accompanied by its recomposition, and so far as the generation and extinction of heat are concerned, it would appear that one of these processes must exactly balance the other.

Water, when decomposed by passing over ignited charcoal, is converted into carbonic acid and hydrogen; if oxygen be supplied in

sufficient quantities by the admission of atmospheric air, this hydrogen will burn with flame, otherwise it will pass off with the products of combustion, without contributing in any degree to its intensity.

In the year 1818, Mr. Morey and Mr. John L. Sullivan each obtained patents for what they called "water burners;" we have not these patents now before us, but we recollect that water, or steam, was admitted among the flaming bituminous fuel, and that its effect was greatly to increase the volume of the flame; we then thought it did this by its expansive force only, and not by any actual increase of the quantity of flame. The method was not found to be productive of the anticipated economy, and the plan was consequently abandoned.

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12. For a *Machine for cutting and chiseling Stone;* Larman Z. Parke and Iram Brewster, the former of Delaware county, the latter of Schoharie county, New York, October 10.

In this machine rows of chisels are to act simultaneously upon a block of stone; an upright frame being made to sustain the apparatus. The block of stone to be cut is placed upon a carriage, or platform, which rests upon rollers, and which can be raised and lowered by screws, or other means. The chisels are retained in their proper positions by moveable racks, or rests, and each of them is raised from the stone by means of a spring acting in a notch at its upper end. Hammers, which strike upon the chisels, are to be lifted by cams placed upon a revolving shaft. The arrangement of the parts, and the modes of adjusting them, appear to be well imagined, and likely to answer the purpose intended.

The only claim made is to the privilege of varying the mode of construction and action, in certain particulars, from that designated in the description.

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13. For a *Machine for shaving the Hair from Deer Skins;* Rodolph Groning, city of New Orleans; an alien who has resided for two years in the United States, October 10.

Three rollers, each about three feet ten inches long, and three inches in diameter, are to be placed parallel to, and at a small distance from, each other in a suitable frame. The skins are to be passed up from below, between two of the rollers, and brought forward under a stationary knife of the length of the roller; a vibrating knife is at the same time made to operate, and by the action of the two, the hair is to be cut off. The claim is to the before described machine. The description, however, is not such as will enable a workman to construct it; the manner of fixing, and the action of the knives, not being made any more clear than they are in the above notice of them.

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14. For a *Machine for Spinning Hemp and Flax,* and other fibrous substances; Daniel Treadwell, Boston, Massachusetts, October 11.

The description of this machine extends to upwards of forty pages, and refers to sixteen figures, in which its respective parts are repre-

sented by drawings. From the nature of the case, it is not possible to present a good idea of the instrument without giving the whole of these. The subjoined extracts, however, are all that we can at present offer. The patentee observes, that "Before proceeding to the description, it will be useful to state, that spinning may be considered as consisting of two operations, first the drawing out of the filament to the required fineness, from a mass of the fibrous material, commonly in the state of roveing, or rolls; and second, the twisting of the filament so drawn, which completes the formation of the thread, or yarn. In some modes of spinning both of these operations are carried on at the same time in the same portion of the material; that is, the filament is elongated during the operation of twisting. In the invention herein described, the filament is drawn to the proper size before twisting it in any degree."

The patentee in his summary at the end of his specification, observes, that it has been necessary for him to describe a great many well known mechanical instruments, in order to show their application in this machine, without intending to advance any claim to the invention of them; and then proceeds to state, under four distinct heads, what he considers as original.

First. The combination of plates, points, pins, clearers, straps, &c. as described, which forms what is called the hatchel belt, and which, with its appendages, serves to draw out the material to be spun.

Second. A combination of instruments which constitute what is called the regulator, with the manner in which it is connected to, and operates with, the other parts.

Third. The combination of the comb, and apparatus by which it is operated upon, for the purposes described.

Fourth. A stopping guide and weight, by which the machine is brought to rest, wherever the unity of the yarn is destroyed.

These claims are guarded by stating that it is not intended to limit them to the precise forms represented, as these may, in every case, be varied, but to embrace that principle, or mode of operation, the character of which is pointed out in the particular description given.

From a very careful examination of the whole subject, as well as from direct information, and from confidence in the solid talents of the patentee, we are of opinion that this machine will prove to be one of great value.

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15. For an improvement in the *Manufacturing water proof Wool and Fur Caps;* Laban L. Macombier, Gardiner, Maine. First issued January 19th, 1831; surrendered and reissued October 11.

In the first patent it was stated that the improvement was for a "composition of matter used in stiffening fur hats and caps, by the use of Indian rubber, (elastic gum,) either in combination with gum shellac or alone." In the present it is said to be for a "mode of manufacturing caps of fur or wool, whereby they are rendered water proof,

and so elastic and pliable as to be folded in a small compass, and packed with clothes in a trunk, or elsewhere, after which they can be made to resume and keep their original shape, by using elastic gum, either alone, or in combination with gum shellac, and other resins."

The elastic gum is to be dissolved in turpentine, petrolium, or any suitable solvent. If shellac is used with it, this is to be dissolved in alcohol, and the two solutions mixed together, in the proportion of one part of the latter to about seven of the former. The solution is applied to the cap, which is then to be steamed until the solution is dry. The bodies of fur caps are then napped in the usual manner, coloured, and ironed. Those of felt are treated in the same way, with the exception of the nap.

The claim is to the application of elastic gum alone, or in combination, as above stated.

We have not seen the hats or caps as finished by Mr. Macombier, but learn that they fully justify the assertion of the patentee, that they bear folding up, and packing away, without injury; we should apprehend, however, that this character must more fully appertain to the cap, than to the hat.

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16. For a *New Portable Oven for Roasting and Baking;* William Goddard, Portsmouth, Rockingham county, New Hampshire, October 12.

This oven is formed of three separate sheets of iron or tin, and is in the form of a segment of a cylinder: in making it, sheet metal of suitable dimensions is bent round so as to form about three-fourths of a circle, the edges are then joined by a flat piece, which forms the bottom of the outer case. A second piece of sheet metal is then bent into the same form, but is to be the segment of a smaller circle than the first, so that when slipped into it, there will be the space of an inch between them; this when in its place, is to be rivetted to the bottom of the outer case. A plate is to be put on at the back end, and a rim fixed, enclosing the space between the two at the front. The space may be filled with charcoal, or other bad conductor, or may be occupied by air only. Through both these vessels two holes for flues are to be made at the top, one near to each end, and these are to lead to one common pipe, furnished with a damper; another hole is to be made for the escape of steam. Heat is to be applied by a round stove, or furnace, under the middle of the oven, a hole being perforated through the bottom sufficiently large in diameter to receive it; and a ring of cast, or of wrought, iron is rivetted to the bottom, in order to give the requisite strength to this opening.

A third box, made in the form of the other two, constitutes the oven proper. This is made exactly in the form of those already described, and is to be slipped into its place within them, leaving a space between it and the second box, and also between its back end and the first, which space is for the passage of smoke and heated air from the fire, around the oven, to the flues. The bottom of this is exposed to the action of the fire in consequence of the perforation

made through the outer box. When this last is secured in its place a door is to be fitted to it in the usual way.

There is no claim made to any part of this apparatus; the security of the patent, therefore, must depend upon the general novelty of its construction.

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17. For an improvement in the construction of *Steam Boilers;* Peter Cooper, city of New York, October 13.

This boiler is one of those which is so constructed as to expose a large surface to the action of heated air from the furnace, by dividing the inside into separate chambers, and by using tubes which communicate from one to the other. Its exterior form is that of a vertical cylinder, the outer case forming a jacket between which and the respective chambers, a portion of the draft may pass.

The furnace is a hollow drum, upon the flat bottom plate of which the fuel is placed; water is contained below, above, and around it. Air is supplied from the ash pit through numerous tubes secured at one end to the bottom of the cylindrical jacket, and at the other to the bottom of the furnace. From the top of the furnace pass up tubes, surrounded by water, and which open into a space under an upper drum, or chamber, containing water. Iron bolts pass from the bottom to the top of this upper chamber, to sustain the heads against the pressure of the steam; and there are similar bolts wherever else they may be thought necessary.

There are several particulars in the construction of this boiler which are claimed, the principal of which are the following:

The mode of constructing the bottom of the furnace of parallel plates, between which water is contained, and through which tubes pass to supply air to the fire; thus obviating the objection to the hollow bars, filled with water, which have been repeatedly tried, without success, as they are apt to burn off in consequence of the water being converted into vapour, an accident which the volume of water and the particular construction of this furnace will prevent.

The separating of the boiler into two parts, and the tubes in the lower one, are also claimed; likewise the outer covering, or jacket, so constructed that the smoke and dust are forced out in a downward direction under the bottom of the boiler; and finally "the combination and form here described, in principle, as well as in detail."

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18. For an improvement in the *Machine for Weighing Wagons, Carriages, Boats, and other bulky substances;* James Coulter, city of Philadelphia, October 14.

This machinery is certainly an improvement upon the kind *first* employed for the same purpose, but not upon several others of more modern invention, and in extensive use.

A platform is to be made of sufficient size to receive the load; which platform is to be suspended, like an ordinary scale, by rods rising from its four corners, and united at the top to a piece of strong timber pendant from the short arm of steelyards. From the long arm

of these steelyards a rod descends to other steelyards placed at a convenient height above the platform and furnished with its moveable weight in the ordinary way.

These are all the essential parts of the instrument, the novelty of which has eluded our view. The claim is simply "to the before described machine."

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19. For a *Rail-road Car, running on a single rail;* Charles F. Zimpel, city of New Orleans, Civil Engineer, late of the Prussian army, but for two years past a resident of the United States, October 15.

The single rail here proposed differs essentially from that patented by Palmer in England, upon which the car was to be suspended. The rail in the present instance is to rest upon the ground in the ordinary way. It does not appear to be the intention of the patentee to propose the employment of his single rail as a substitute for railroads for general traffic, but principally to be used on plantations, such as the sugar plantations of Louisiana, for carrying the cane to the sugar house, or the transportation of other articles to be conveyed a short distance only. The rail is to be entirely of timber, the whole width of which will be somewhat upwards of two feet.

There are to be two main wheels, one at each end of the car, which are to be about two feet in diameter, and one foot thick; it is proposed to make the face of each wheel concave for about six inches, leaving a tread of three inches at each edge. These wheels are to run in forks formed at the ends of the piece of timber which constitutes the perch, or beam, of the carriage. The body of the car is to hang on pivots at its upper edge, allowing it to vibrate laterally. For this purpose, posts rise vertically from each end of the perch, and receive the pivots by which the body is suspended.

The main part, or centre, of the rail, upon which the wheels run, must be somewhat more than a foot broad, and to each side of this main piece other rails are to be fastened, each six inches broad, and rising four inches above the main rail. The wheels therefore run in a trough four inches in depth. Upon the axles of the wheels, which are extended out at each side of them, there are safety wheels, of such diameter as not to touch the additional rails when the car is vertical, but to come into contact with them should it tilt on one side.

It is stated that the object of hanging the car upon pivots is to preserve the centre of gravity; but it is evident that if it swings either way it must carry the centre of gravity outwards, and tend the more to upset. There is no provision made for turning on a curve, and it would seem, therefore, that the road must, in all cases, be absolutely straight.

Although no claim is made, the novelty of the general arrangement appears to be sufficiently obvious.

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20. For an *Instrument for scraping Broom Corn;* Billy J. Billings, and John S. Billings, Gorham, Ontario county, New York, October 15.

An instrument much in the form of the common vertical reel, is made to revolve, carrying scrapers, or knives, at the ends of its arms, which scrapers, or knives, are to clear the broom corn from seed and dust. The corn is held in the hand, and laid upon the curved bed over which the scrapers revolve. The patentees state that by this machine they are enabled to do much more work than formerly, and that by its operation the seeds and dust are driven away from the workman.

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21. For *Tubular Essence Phials;* John Staniford, city of Boston, October 17.

Essence bottles, instead of being blown in the ordinary way, are to be made out of glass tubes; they will, consequently, be much more regular, neat and beautiful than usual. In this mode of making them the roughness upon the bottom is avoided, no punty being used in forming them; and the patentee states that they can be afforded at the same price which is paid for the inferior article.

Tubes of the proper size are to be divided into lengths sufficient to form two phials; each end is to be successively heated by a glass-blower's lamp, and the brim and neck shaped by pincers made for the purpose; the tube is then to be heated in the middle, separated, and the bottoms rendered perfectly flat and smooth by pressure against a piece of iron. In shaping the phial, an inclined plane is placed beside the lamp, upon which the tube is rolled.

There is no direct claim made, but the novelty, according to the statement of the patentee, appears to consist in the use of this inclined plane, and in the particular form given to the pincers to adapt them to the intended purpose.

The making of phials from glass tubes is not new; we have occasionally seen in use such as have been so made, and there is, probably, no one in the habit of blowing glass by means of the lamp, who has not made them for his own amusement, although they may not have been manufactured for the purpose of giving a general supply. The patentee might fairly claim whatever there is of novelty in his mode of procedure, but not the mere making of phials from tubes.

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22. For an improvement in the *Book Binder's Cutting Press;* Charles Stimpson, city of Boston, Massachusetts, October 17.

The improvements here claimed are two; first, the suspending of a board under the press, which shall serve as a gauge upon which the book to be cut may rest, instead of adjusting it as heretofore, by the aid of a mark made on the edges of the paper; there are to be three screws with nuts on them to support and adjust this board, or gauge; two of them descend from the right hand cheek, and one from the middle of the left, each of them passing through the board, and having nuts underneath it. The second improvement is the fixing of the two strips of wood, called the square, and cutting board, to the cheeks of the press, by means of screws, so formed that they can be

readily adapted to other squares and cutting boards, instead of replacing them every time a book is put into the press.

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23. For an improvement in the *Steam Engine;* Ithiel S. Richardson, Newmarket, Rockingham county, New Hampshire, October 17.

The improvement here proposed is as new as a great many others for which patents are taken; therefore, if not quite novel, it has fellows to keep it in countenance.

The proposition is to employ two or three cylinders with rods from their pistons operating upon the same shaft, the cranks making such angles with each other as shall correspond with their number, so that one or more may always be in action, and thus the necessity for a fly wheel be obviated.

If the plan itself is not new, at least some of the advantages which, according to the patentee, it is to produce, are truly so. One of these is that the steam will be constantly flowing into one or other of the cylinders, and thus all danger of explosion be avoided; another is the getting the same power with a diminished portion of fuel; the how or the why *we are not* told.

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24. For *Making Sleys and Reeds for Weaving;* Horace Holt, Rutland, Meigs county, Ohio, October 17.

The general construction of this engine, is that called the vibrating reed engine, but the feeding, instead of being regulated in the ordinary way by a spring, is effected by means of a screw having a cog wheel on its end, mashing into another cog wheel operating on the flyers. When the machine is to be drawn back, a spring box, forming the nut of the screw, is withdrawn, and the desired motion effected.

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25. For an improvement in *Pumps;* Noble Phelps, Turin, Lewis county, New York, October 20.

The improvement claimed, is in the piston, or bucket, and in the manner of placing the valves; the other parts, we are told, are to be made as usual. The piston is to be a leather bucket in the form of the letter V, into which the lower end of the piston rod is to pass, and to be securely nailed there. Two straps of leather nailed to the piston rod above the bucket, descend, and are attached to the latter, supporting it like a bail. There are, it seems, to be two valves below the bucket; one at the bottom of the chamber, and the other in its usual place. The use of these we know not, as the bucket, if it operate at all, must act as a valve, collapsing as it descends, and expanding in its ascent. The use of three valves in a common pump we are yet to learn, its disadvantages are easily shown. We are informed that in consequence of the use of this conical bucket "the working chamber may be enlarged to any convenient size, so as to convey a large quantity of water to the spout." We presume, however, that in this, as well as in other pumps, the power must be increased with the increase of size in the chamber; if this be not the

case we are ready to concede to the magnitude of the said improvement.

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26. For a *Parturient and Invalid Bedstead;* Joshua N. Robbins, Troy, Rensellaer county, New York, October 20.

This bedstead, "not known or used before" very much resembles several other invalid or hospital bedsteads, parts of it being made to raise by means of racks and pinions; and other contrivances being appended for the relief of those who require them. The patentee describes the whole without claiming any part, and although we might point out such minor differences between this and others as will be made by different workmen in structures which are essentially the same in principle, we should be unable to do more than this, and could not, therefore, supply the deficiency in the specification.

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27. For an improvement in *Paving Streets;* John L. Sullivan, city of New York, October 20.

The common effect of moisture, and more especially of frost, in loosening the earth under pavements made in the ordinary mode, are enumerated by the patentee, and the object which he proposes to accomplish, is to guard against these injurious effects, by laying the pavement in a cement which shall prevent water from insinuating itself between, and passing under the bricks or stones employed, and as the earth will thus be kept in a uniform state of dryness, that expansion which always accompanies freezing will be prevented, and the pavement remain permanent.

The ground is to be prepared by giving to its surface the proper form, and by consolidating it by means of rollers or rammers. Water, lime, or other impervious cement is then to be spread over the ground in a semi-fluid state; upon this the paving stones are to be laid as close to each other as possible; the interstices between them are then to be filled up by pouring upon them the same fluid cement, after which pulverized stones are to be strewed over and rolled down, the superfluous portion being scraped off as the work proceeds.

The principle, or mode of procedure, claimed, is the paving with common paving stones, or fragments of quarries, and setting them in with impervious cement. In the March number of this Journal for the year 1828, p. 179, there is a specification of an improved method of paving, for which a patent was granted in England, and which method is nearly identical with the preceding. The laying of stones in impervious cement, was practised by the ancients; the Roman ways may serve as examples; the practice has been followed in many parts of Italy, and in other countries, to the present day; a patent taken for doing so, must, therefore, be restricted in its object to the precise mode described by the patentee.

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28. For *Measuring for and Cutting Garments;* James Henderson and Cooper K. Watson, Zanesville, Muskingum county, Ohio, October 12.

If a judgment may be formed of the progress of any art by the *improvements* in it which are registered in the patent office, that of the tailor has not lagged behind in the grand race. It is not to the patent office alone, however, that we are indebted for a proof of this fact; no mean portion of the literature of the day has been devoted to the same subject, and we meet, almost everywhere, with pictorial illustrations of the variety of modes in which "nature's noblest work" may be embellished, or distorted, by the directors general of the fashionable world.

We have neither the theoretical nor the practical knowledge necessary to perceive the nice shades of difference in the various instruments contrived to assist the professional artist, and from fear of displaying our ignorance, as we have not had room for the whole, we have hitherto given but a brief and general view of them, a practice from which we shall not venture to depart on the present occasion.

The principal instrument now before us consists of a vertical measuring rod, sufficiently long to take the altitude of the tallest man. Upon this standard there are three sliding pieces with projecting arms, which are to be adjusted so as to mark the three cardinal points in the longitudinal admeasurement. To the uppermost of these slides, a scale of about three feet in length is attached; this scale slides in a groove in the standard, and is provided with graduated divisions, the correspondence of which with, or relationship to, other divisions upon the standard, indicate the manner in which the garment must be marked, before the shears are employed. These indications are properly explained in the specification, to which those interested are referred.

For the rotular and diagonal admeasurements, leather straps are employed, which are to be properly graduated. In the art of drafting the garment, a square is to be used, which square has graduations upon it corresponding with those of the general system, and adapting it to individuals in all their varying proportions.

The claims are to "the groove in the standard by which the length of the body, and a certain permanent point for the waist are ascertained; and to the straps by which the various curves and irregularities on the surface of the body are measured, and also the square described, and the manner of ascertaining the curve of the waist and spring of the skirt."

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29. For an improvement in the *Machine for breaking, dressing and cleaning of Hemp and Flax;* and softening and freeing the filaments entirely of shivers; La Fayette Tibbots, New Glasgow, Amherst county, Virginia, October 22.

Mr. Tibbetts refers to a machine for the same purpose, patented by him on the first of August, 1829, as the foundation upon which rest the improvements now proposed; that is, upon what he calls the "arch principle." His improvement consists, he tells us, in re-acting powers, which drive the gearing of his rollers thirteen feet, more or less, forward; which power returns back again to the point whence

it started, like the vibration of a pendulum. This gearing is so constructed, however, as to cause the action of the breaking rollers to be greater in the forward, than in the backward direction; and the claims made are to "the principle of the vibrating or re-acting powers, which revolves the fluted rollers as far forward as back; together with the construction of the power gearing, the position of the parts, and the manner of operation of the instruments generally; also, the re-action or vibration of said rollers in their revolutions to operate further forwards than backwards, in order to gain from three to twelve inches in each vibration." The principle of vibration is also claimed, without restriction to any particular form of gearing, or instruments for effecting it.

Many patents have been taken for machines for breaking hemp and flax, and much money has been unfortunately spent in their erection, whilst but few, if any, of them have continued in use sufficiently long to test their adaptation to the purposes intended, and to correct those imperfections incident to a new machine. For the cause of this we must inquire further than into the mere construction of the machines themselves. The culture of the raw material, with us, may be said to have hitherto been a failure; either from soil, climate, or inexperience in management, our hemp is inferior to that imported from Russia, and whilst this is the case, neither our national or mercantile marine will be trusted to cables, hawsers, or sails, manufactured from it. For ourselves, we are equally unwilling and unable to believe, that in our widely extended country, a country affording almost every kind of soil, and variety of climate, a plant which grows so luxuriantly in many situations, must necessarily be inferior in those properties which give to it its greatest value; we will, therefore, still indulge the hope, that perseverance, and consequent experience, will yet suffice to establish an article so necessary both in the arts of peace and war, as one of our staples.

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30. For an improvement in the mode of *Thrashing, cleaning, and grinding of Wheat* and other grain; La Fayette Tibbotts, New Glasgow, Amherst county, Virginia, October 22.

The description in both this and the preceding patent, is, to us, very defective in point of clearness. We shall not, therefore, attempt to designate the particular improvements made. In the present machinery there are several things claimed, but in that broad way which does not very clearly distinguish the same from all other similar things before known or used. This the patentee calls a portable or local mill, and of it he claims *the principle.* "Also the principle of the bridge tree and rattle staff springs, and the bridge tree rod and rattle staff hollow screw for regulating the mill, together with the application of the bolt to receive the meal from the mouth of the spout," &c.

When Oliver Evans introduced his improvements in mills, such as the elevators, hopper-boy, &c., their nature and use were of easy designation; we saw clearly in what they consisted, and could easily answer the questions, what are they? and what are they for? the pre-

sent, however, are more recondite, and we must refer inquirers to the inventor.

The thrashing machine, included in this patent, may be driven by the same power as that which drives the mill; the latter being "local," (*locomotive*, we suppose,) may be removed, and the former applied. The claim in the thrashing part is to "the principle of double action in thrashing wheat and other grain by beaters, rollers, &c. &c.; or by any two or more revolving motions, one above the other, so as to let the straw containing the grain pass between said motions of beaters, &c. The said principle of revolving beaters, *above* as well as *below*, all turning inward, and drawing the grain in the straw through between them, as fast as the feeding rollers deliver the same, is what I claim under the principle of double action, by pairs of beaters or otherwise."

The *principle* spoken of as applied to the thrashing machine, is the placing around a large cylinder, three or more smaller ones, in the manner of the small carding rollers in a carding machine.

Without attempting to touch the question of novelty; there appears to us to be two objections against the specification of this patent, *first*, the things claimed are not presented with sufficient distinctness; and *secondly*, it is not a patent for *a machine*, but for two separate machines. There is no more necessary connexion between the thrashing machine and the mill, than there is between the mill and a baker's oven, yet it would appear rather strange to take out *one* patent "for a mill for grinding meal, and an oven in which the same may be baked into bread."

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31. For an improvement in the *Construction of Chimneys;* Henry Antes, Harrisburgh, Dauphin county, Pennsylvania, October 24.

A single flue is to be carried up from the cellar to the top of the chimney, and into this flue a throat passes from every fire place. These fire places may stand back to back, so that six fire places, on three floors, may open into the same flue, which, in this case, we are told, may be three feet wide, by one foot two inches in the clear. Air flues, to supply a draught from without the room, are to pass down the jambs, and open into the fire places. The ashes are to be conducted into the main flue, through openings made for that purpose, and are to fall into an ash pit in the cellar, where there is a man-hole, closed by a door. Shutters, or registers, are to be applied to each of the throats of the fire places.

The claim "is the improvement before described; particularly in proportioning the inlets to the capacity or area of the flue of the chimney, and in requiring only one flue for any number of fire places in the same stack."

We apprehend that separate flues to each fire place, would be an *improvement* upon this plan, although, in certain cases, we have known one common flue to answer well for six furnaces. We know of a chimney, built nearly forty years since, for a casting shop for a brass

founder, which consisted of one wide flue in the wall, into which six furnaces opened, and we also know that the draught was perfectly good, better, in fact, than in ordinary furnaces, whenever all the furnaces were in blast; but when the number was diminished, the air in the large flue was not sufficiently rarified, and the draft was proportionally decreased. Such will be the case with the chimnies in question; if fires are lighted in every fire place, it may do well enough; but, if otherwise, one of "the miseries of human life," a smoky chimney, will have to be encountered. The throats of two fire places opening against each other, as shown in the drawing, is a part of the plan which will be found not to answer in practice.

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32. For a *Thrashing Machine;* William Prescott, Pottsville, Schuylkill county, Pennsylvania, October 25.

We have here a thrashing machine which affords us some relief from that eternal round to which the whirling cylinders of most others are to be subjected. We in this case return, it is true, to something like the older thrashing machines, those which existed before the first Scotch cylinder machine was made.

By the present machine the thrashing is to be performed on the barn floor, by rows of flails, or beaters, acting like those for batting wool and cotton. The four legs of the frame have grooved rollers on them, which run upon parallel bars, forming a rail-way along which the machine may be shifted, to prevent the continuance of the blows on the same spot. A shaft carrying a fly wheel, is to be turned by a crank; this, by means of two other cranks and pitmen, gives a partial rotary motion to rollers working on gudgeons in the frame, on either side of the machine. These rollers sustain rows of flails or beaters of wood, which are connected to them by elastic bars, serving as springs.

When horse, or other sufficient power is used, the number of flails, rollers and cranks may be increased.

The claim is to "the before described machine, for thrashing grain by means of vibrating flails."

The "before described machine," although differing something in arrangement from others acting upon the same principle, is so similar to them, that we think it should have been said in what part the improvement resided, we also think that this might have been done.

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33. For a *Machine for Hulling Clover;* Pearson Reading, Trenton, New Jersey, October 25.

There is to be a revolving cylinder set with iron teeth, and rows of iron plates; the cylinder may be about three feet long; this is to revolve within a barrel, or casing, made of staves and set with iron teeth. The casing is to be a little conical, allowing more space at the feeding than at the delivering end. The seed is to be put into a hopper, and forced down on to the cleaning roller by a follower. We are told, that by removing the casing, and supplying a hollow segment, set with teeth, it may be converted into a thrashing machine.

Whether this is intended to make a part of the patent, or in what the peculiar merits of the machine consist, we are not informed, as there is no claim made.

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34. For a *Machine for Planing Plank and Boards;* Ebenezer Lane, Cincinnati, Hamilton county, Ohio, October 26.

Plane irons, of the ordinary kind, are to be placed in a row, about two inches apart, when the irons are two and a half inches wide. The stock in which they are fixed is to be of cast iron, and the irons must stand the reverse way from what they do in a common plane, their cutting edges being towards one side of the stock, all the irons in it lying in the same plane. Another stock is to be prepared to stand behind the former, with the irons placed between the spaces of the first, and in this way several stocks may be arranged. These are then to be fixed in a strong wooden or iron frame, one behind the other. This frame may be stationary, and a carriage, or bench, running upon wheels, and bearing the stuff to be planed, may then be forced under it by any adequate power; or the plank may be stationary, and the frame, with the cutting irons, carried over it.

The claim is to the frame containing the plane irons, and to their arrangement.

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35. For a *Thrashing Machine;* Ebenezer Gordon, and David T. Gordon, Oswego county, New York, October 27.

We have nothing very particular to say respecting this machine, as its history has already been given in the detailed accounts of some of its predecessors. It consists of the ordinary cylinder and concave set with teeth. The specification enters into a very minute description of its respective parts, and contains every thing relating to it with the exception of that which is of some importance, to the patentee at least, namely, the designation of those parts which are new, and upon which the claim to a patent depends; to have pointed out these, however, might possibly have "puzzled a Philadelphia lawyer."

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36. For a *Chimney Valve;* John Baker; Lancaster, Lancaster county, Pennsylvania, October 28.

We may next look to see a patent taken for handkerchiefs to be worn in the pocket; for although they are somewhat more common than valves in chimneys, their claim to novelty is about equal.

The valve proposed, is a shutter of cast or wrought iron, fitting in, and hinged to a frame in the chimney, with a segment rack to support it at any desired height. Having a wife and children, and gray hairs which tell of olden time, we have nothing to fear from the averment, that when we first saw such valves in chimneys, nearly half a century ago, they were no novelties.

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37. For additions and improvements in a machine patented on the 4th of November, 1830, called a *Machine for Scraping the Flesh and Hair from Hides and Skins*, and for all other scrap-

ing necessary in tanning and currying leather; Thomas Williams, Rochester, Monroe county, New York, October 31.

For the general construction and use of this machine, we must refer to the specification, p. 173, vol. VII. The improvement now claimed is the application of a cylinder with knives, placed either straight along it, or obliquely; (the oblique position favouring the spreading of the skins,) with a concave against which the roller acts, and which is borne up against it by means of spiral springs. The various parts for giving motion to the machinery are also claimed, as "the application of the carriage and its appendages, and of the crank, levers, cog wheel and pulleys, pinion, and cylinders, to the purposes for which they are to be used in the said machine."

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38. For an improvement in the *Construction of Steam Boilers, to regulate the height of Water within them;* Dummer M. Hooper, New Albany, Floyd county, Indiana, October 31.

A float, made of any suitable materials, such as wood, cork, or metal, is placed within the boiler, and is to rise and fall with the water in it. A vertical rod attached to the float, slides through guide pieces, which retain it in its proper position. The upper end of the rod is made conical, that it may operate as a valve, the seat of which is the open end of a steam tube, which passes through the top of the boiler; when the float is borne up by the water, the valve comes in contact with the lower end of this pipe, and closes it; when the float descends, by the diminution of the water, the valve is to open, and allow steam to escape through the aforesaid tube. This tube does not lead to the cylinder of the main engine, but is intended to set a separate small engine at work, made expressly for the purpose of operating upon supply pumps to fill the boiler.

The inventor says that "this mode of supplying boilers with water by an engine expressly for the purpose, which is put in motion or stopped by means of a float within the boiler, which I call an 'improved self-regulator,' is what I claim as my invention."

The necessity of employing two engines in the place of one, would, alone, present a formidable difficulty in the way of introducing this plan, were there no other objection to it; should it appear, however, that if adopted it would not answer the intended purpose, this must be fatal to it, and such we unhesitatingly say would be the fact. The motion of the water in the boiler would keep the valve in a state of constant agitation, whenever it descended near to the point at which the valve should open; nor would the steam ever pass off in a stream sufficient to set the engine at work which is to operate upon the force pumps; and were it possible to set it in action, it must stop the moment the valve closed, and thus continue perpetually starting and stopping. Every practical engineer will, we apprehend, concur with us in pronouncing the scheme altogether fanciful.

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39. For an improvement in *Making Glass Knobs;* Spencer

Richards, Cambridge, Middlesex county, Massachusetts, October 31.

The improvement here patented is the insertion of a brass nut in the body of the knob, with a hole leading to it from the lower part. Into this nut a male screw may afterwards be passed, by which the knob may be fixed to drawers or shutters without the use of a tapped nut. In the common way of making knobs, a hole is left entirely through them, and the shank by which they are fastened, has its head on the top of the knob; by the present method, the top of the knob is whole, the perforation extending no further than to allow the screw shank to pass into the nut.

Pressed knobs have been frequently made with screw shanks imbedded in them, but they are apt to break the knob, an objection which will probably be removed, or much lessened, by inserting them into a nut in the manner proposed.

ENGLISH PATENTS.

To John Burgis, *ornamental paper manufacturer, for his new invented method, or methods, of gilding, or silvering, certain woven fabrics in burnished, or burnished and dead, or matted gold or silver, and which said fabrics may be used as gold or silver, and lace borderings, and for other purposes. Sealed 5th February,* 1829.

The very great expense of gold and silver lace, has induced the patentee to invent a simple and cheap mode of manufacturing an imitation of that costly material, which he proposes to employ in decorating curtains, chairs, and other articles of household furniture. The material to be employed is fine cotton or other cloth, upon which a coating of gold or silver leaf is to be laid, by the ordinary process of gilding and silvering. The cloth is then to be cut into narrow strips, and wound round cords to resemble cords of gold, which cords may then be plaited or otherwise woven into lace of various kinds. The cloth about to be operated upon, is first dyed, (if for gold, of an orange or yellow colour.) It is then to be stretched out upon a flat surface, and covered with a coating of size, made of parchment shavings, in the same way that gilder's size is commonly made. When dry, the reverse side of the cloth is to be sized in the same way.

After this preparation, two or three coatings of the material called gold size is to be laid upon that surface of the cloth which is intended to be guilt; this size being made of gelatin, with pipe clay and ochre, or other yellow colour. When the materials have become perfectly dry and hard, the surface is to be polished smooth, and all hairs or small pieces of grit removed.

The cloth being tightly distended upon a flat surface, is now to be sponged over with water, and then the leaf gold laid on smoothly

with a gilder's camel hair brush, taking care that all the fractured parts of the gold leaf are afterwards carefully covered with fresh pieces of gold leaf, so as to leave no parts of the surface ungilt.

When the gilding has become perfectly dry and hard, the cloth may be passed over a roller, and brushed, for the purpose of burnishing its surface; and if it has been gilt on both sides, that part of the cloth which is undermost should be carefully covered with paper, to protect it from injury while under the operation of the burnishing brush. But when dead gold is required, then the burnishing brushes may be dispensed with.

The cloth having been thus gilt, is then to be cut into strips of any required width, in a machine, with knives or shears, placed at suitable distances, in order that the strips may be perfectly parallel. These strips are then to be wound or bound round cords of suitable thicknesses, the cords having been previously dyed of an orange or yellow colour; and the cords, after having been so covered with the gilt cloth, may be twisted together to represent bullion, or in any other way plaited or woven in the manner that gold lace is commonly made. Precisely the same operations are to be performed in the preparation of silver lace.

This artificial gold or silver lace may be applied as cording or bindings for the edges of chairs, sofas, &c. or for the fringe of curtains and other drapery. [*Lond. Jour.*

To THOMAS, WILLIAM, *and* JOHN POWELL, *of the city of Bristol, glass merchants and stoneware manufacturers, for their invention of certain improvements in the process and machinery, or apparatus, for forming, making, or producing moulds or vessels for refining sugar; and in the application of materials hitherto unused in making the said moulds. Sealed 17th May,* 1828.

THE patentees propose to make the conical moulds, or vessels, in which refined or loaf sugar is moulded from stoneware clay, and to glaze them both within and without.

In the first instance, the stone ware clay is to be prepared in the usual manner, and is then to be put under a press, for the purpose of bringing it into a sufficiently stiff and compact consistency. In the bottom of the vessel in which the clay is pressed, a mould is placed, consisting of a flat board, with a broad conical aperture cut out of its centre. In this aperture of the board the clay is to be shaped which is to form the vessel.

As the board lays flat under the press, the clay will necessarily be forced into the recess, or aperture; which being done, it is then cut off level from the clay which is above it, by passing a wire or string, or thin cutting blade over the surface of the board, which leaves the portion of clay thus moulded in a thin slab of a broad conical form.

This slab of clay, while in its plastic state, is then placed round a conical block, so as to cover the block perfectly, and any small de-

fects which may be left at the junctions of the edges of the slab, are to be made up with small portions of clay, laid on with a spatula or palette knife.

The block is now set in a convenient situation, where the coating of clay may be dried by the air; and when it has become completely dry, the block is fixed upon a rotary spindle passed through its axis, and the outside of the clay vessel is turned perfectly smooth in the same way as stoneware articles are usually made.

The shell of clay being then slipped off its block, will be found to be an accurately formed conical vessel, having a small hole in its apex, and suited for the purpose of a sugar mould, perfectly smooth both within and without.

Any number of these conical vessels may then be placed upon their bases side by side, in an oven, for the purpose of being baked, and they are to be glazed within and without by salt, as clay stoneware is usually glazed. [*Lond. Jour.*

To JOSEPH CLISILD DANIELL, *Clothier, for certain improvements applicable to the manufacturing and preparing of Woollen Cloths. Sealed 5th August*, 1828.

THERE are two objects proposed under this patent: the first is designed to preserve a uniform tension in the warp threads of a cloth loom; the second, to give additional force to the beaters of a stock for fulling cloth.

In the first instance, the loom is not intended to be altered in its general construction from ordinary looms for weaving cloth, but there is affixed to the end of the warp roller a pulley, over which a weighted cord is passed for the purpose of drawing the warp tight, and at the same time allowing it to be given out as the batten beats up the work. A similar pulley is also attached to the end of the work roller, with a weighted cord passed over it in the opposite direction to the former, in order to draw up the work. Hence the warp threads are always kept at a uniform tension, and when any additional force is exerted as in beating up, a small portion of the warp only is given out, by the roller slipping round under the weighted cord.

The second feature of the invention applicable to fulling stocks, is designed to supersede the present mode of allowing the beaters to fall from a height by their own gravity, and to effect the beating and milling of the cloth by their descent. Instead of this it is proposed to raise the beaters but a short distance up from the cloth in the cell of the stock, and to give forcible effect to their descent by means of powerful springs acting at the back of the arms of the beaters.

The adaptation of springs to the backs of the beaters, for the purpose above stated, may be effected in various ways, and by several kinds of springs, all of which the patentee claims as coming under

his invention, and the advantages anticipated are that considerable time may be saved in the performance of the fulling or milling process, by shortening the stroke of the beaters, which will allow of a much more frequent repetition of the blows than when the beaters are allowed to fall from a height; and the power of the spring upon the improved plan may be made to give an equally effective blow to that produced in the ordinary stock by the descent of the beaters from gravitation. [*Lond. Jour.*

Specification of the patent granted to ROBERT STEPHENSON, *Engineer, for an improvement in the Axles and parts which form the bearings at the centre of Wheels for Carriages which are to travel upon edge Rail-ways. Dated March* 11, 1831.

To all whom these presents shall come, &c. &c. *Now know ye,* that in compliance with the said proviso, I, the said Robert Stephenson, do hereby declare, that the nature of my said invention, and the manner in which the same is to be performed, is particularly described and ascertained as follows, (that is to say):—

My improvement in the axles and parts which form the bearings at the centres of the wheels for carriages which are to travel upon edge rail-ways, consists in fixing two of the said carriage wheels fast upon the extreme ends of a long, hollow or tubular axis, within which a solid central axis is inserted, extending through all the length of the hollow, and projecting out sufficiently beyond each of the hollow axes to enable the weight of the carriage to be supported upon the projecting ends of the solid central axis, around which the hollow axis turns, together with the two wheels which are both fastened, (as aforesaid,) upon the ends of the hollow axis.

In the carriages now used upon the Manchester and Liverpool Rail-way, each pair of wheels are fixed fast on the two opposite ends of a long solid axis, which revolves with the wheels, and the two extremities of the solid axis which project out through the centres of the wheels, are formed into pivots or gudgeons, and are received in suitable sockets, whereon the weight of the carriage is borne by the hollows or concavities of those sockets pressing downwards on the pivots. In travelling with great rapidity, the said pivots require a copious supply of oil, much of which is wasted, because the hollows or concavities of the sockets, (which do not revolve,) are inverted, in order that they may bear downwards upon the upper parts of the circumferences of the revolving pivots of the axis; consequently, the oil has a tendency to run down and escape from the places of bearing where it is wanted. According to my improvement, it is the central axis which does not revolve; and it is the lower parts of the circumference thereof which apply and bear downwards within the hollows

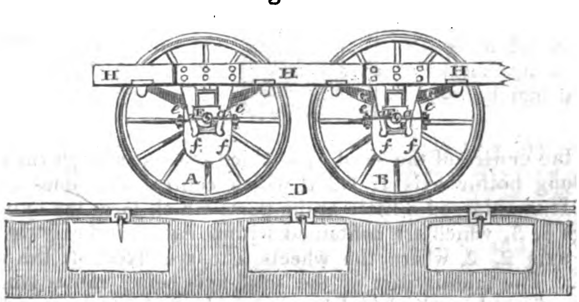
or concavities of the hollow axis, which does revolve around that central axis; consequently, the oil has a tendency to run down into the places of bearing where it is wanted; the action thereof being (in that respect,) the same as in the axles and boxes of common coach wheels, wherein the axle does not turn round, but the box in the centre of the wheel turns round about the axle.

For travelling on edge rail-ways the wheels on the opposite sides of the carriage require to be firmly united, so that they will turn round together in pairs, in order to prevent one wheel from advancing either faster or slower along one rail than the other wheel advances along the other rail. On the common plan of coach axles and boxes, the wheels of each pair being quite independent one of another, one wheel can turn round without the other wheel; and hence such axles and boxes are unsuitable for the wheels of carriages which are to travel upon edge rail-ways; and hence the mode above stated has been introduced; videlicit, that of fixing each pair of wheels upon a solid axis, which turns round with them, and compels them both to go together: according to my improvement of fixing the two wheels upon the extreme ends of a long hollow or tubular axis, as aforesaid, the pair of wheels are firmly united together, so that one wheel cannot advance more along one edge rail, than the other wheel does along the other rail; and that circumstance, (which is an important condition for travelling with safety and rapidity on edge railways) is combined with the advantage of the ordinary coach wheel axles, in respect to their supply of oil; videlicit, that the bearing of the solid axis which does not turn round, presses downwards into the hollows or concavities of the hollow sockets, which turn round with the wheels, giving the oil a tendency to insinuate itself between the bearing surfaces.

Description of the drawing.

The drawing hereunto annexed, represents so much of a carriage which is to travel upon an edge rail-way, as is necessary to explain my improvement. Fig. 1 is a lateral elevation of a four wheeled

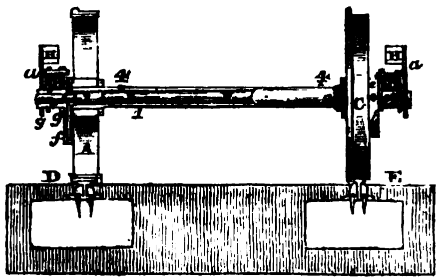
Fig. 1.



carriage, suitable for conveying goods on an edge rail-way, showing the two wheels A B, which follow each other along the same rail D of

the rail-way. Fig. 2 is a transverse section, answering to fig. 1, and

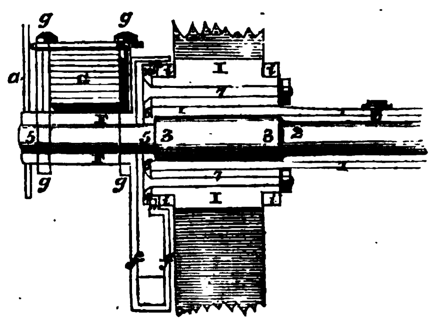
Fig. 2.



showing one of the pairs of wheels A C, which are at opposite sides of the carriage; one running on one rail D, and the other on rail E.

The pair of wheels must be united together, as before mentioned, and that is done by means of the long hollow or tubular axis 1, 1, the two ends of which are inserted and firmly fastened into the central holes of the two wheels A C, so as to keep them at the proper distance apart, to suit the space between the rails D E, and to keep them firmly vertical when they turn round. One of the wheels A is represented in section, as if it were cut through the centre by a vertical plane, to expose the interior parts, and that section is repeated on a larger scale in fig. 3. To explain the structure of the parts,

Fig. 3.

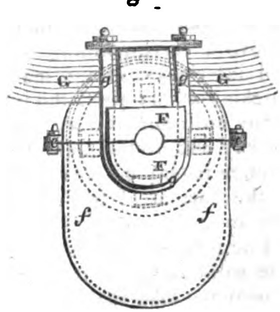


2, 2, is the centre of the solid axis which passes through the interior of the long hollow axis 1, 1, but which central axis does not turn round. It is enlarged a little at the parts which form the cylindrical bearings 3, 3, which are contained within each of the ends of the hollow axis 2, 2, where the wheels A C are fixed on the outside thereof. The middle part of the solid axis being rather smaller in diameter than the cylindrical bearing parts 3, 3, a space is left vacant all round the solid axis, within the hollow axis, to contain a stock of oil. When that stock requires to be renewed, a supply of

fresh oil is poured into the vacant space through two holes at 4, 4, which are then stopped very tight by screw plugs. When the carriage is in use, the oil makes its way from the middle part of the hollow axis, towards each end thereof, where the bearings are, and thereby the bearing surfaces are kept constantly supplied with oil. The ends of the central axis, which project out beyond the ends of the hollow axis, are also smaller in diameter than the cylindrical bearing parts 3, 3, as shown at 5, fig. 3.

The weight of the carriage is supported upon those projecting ends 5, each of which is for that purpose received in a socket F F, made in two halves screwed together, as shown in fig. 4 and in fig. 2, by four small bolts, *e*, *e*, and also by the two staple bolts *g*, *g*, which fasten the springs G down across the upper flat sides of the socket F; and the pressure of all those screws binding the two halves of the said socket F firmly together, around the end 5 of the solid axis, fastens the socket to the axis. The outer end of the socket F is fitted into a vertical groove, formed in the space between the two prongs *a*, *a*, of a forked plate of iron, which is screwed to the horizontal side rail H of the carriage, as shown in fig. 1, and projects downwards therefrom. The ends of the springs G apply to the underside of the side rails H, and bear the weight of the carriage; the middle parts of the springs being borne upon the socket F, to which they are fastened, as before stated: and when the springs bend, (by the jolting motion of the carriage in passing over the joinings of the rails, or other uneven places,) the sockets F rise and fall in their vertical grooves *a*, *a*. To confine the hollow axis with the wheels from having any unnecessary end play on the solid axis, circular plates or rings of metal are fastened one against each end of the hollow axis, being bolted fast to the flat surfaces of central bosses or naves I of the wheels; and those rings having small circular projections, which enter a little way into the ends of the hollow axis, (as shown at 6, fig. 3,) those projections apply to the shoulders, which are formed on the solid axis by the enlargements 3, 3, which form the cylindrical bearings thereof.

Fig. 4.



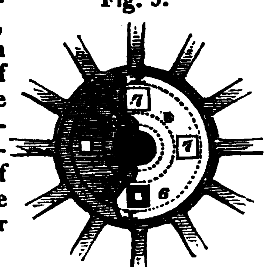
The central hole through each of the rings 6, is only just so much larger than the end 5 of the solid axis, as to allow of a free turning motion; but the central projection which enters into the end of the hollow axis, is fitted very tight therein. A large washer of leather is interposed between the flat surface of the ring 6, and the corresponding flat surface of the central boss or nave I of the wheel; and the ring 6 is bound fast thereto by screw bolts 7, 7, which pass through the boss I of the wheel, having their heads countersunk into the ring 6, and having nuts screwed on their opposite ends, which project through the boss of the wheel.

The ring 6, with the leather washer, prevents any oil getting out, except that which makes its way between the central hole of the ring 6, and the end of 5 of the axis; and in order that the oil which so makes its way may not drip away or run down the arms of the wheel, and get to the rails, or be lost, a hollow oil box *f f*, is provided to receive and save the oil which escapes. The said box is cast in the same two pieces with the socket F, before described as being in two halves; when they are put together, the oil box *f f* clasps around the outer end of the nave I of the wheel; and the circular rim *x* of the ring 6 projects beyond the flat surface of the nave I, against which it is fastened by the bolts as aforesaid; and the part *x* so projecting, being opposite to the flat surface of one of the circular hoops *i*, (by which the nave is bound and strengthened,) forms a circular groove around the circumference of the nave I, into which groove a corresponding interior rim *m*, *m*, of the oil box, projects and interlocks, in the manner shown in the section; and without touching at any part, the interlocking prevents the escape of the oil, or the entrance of dust into the oil box; but all the oil which makes its way out of the hollow axis will be caught in the oil box, from whence it may be drawn off through a suitable plug hole or tap cock at the bottom of the oil box, when a quantity has accumulated therein.

The form of the oil box *f f* is fully explained by figs. 2, 3 and 4. The solid axis 2, 2, is made of wrought iron of competent strength to bear the load that the carriage is to convey. The dimensions represented in the drawing are adapted for a carriage of four tons weight when loaded, (being one ton bearing upon each wheel.) Figs. 1 and 2 are drawn to a scale of one-eighth of the real size; and figs. 3, 4 and 5, are one-half of the real size.

The carriage is represented with wheels three feet diameter, made of cast iron in one piece, and surrounded with wrought iron tires to run upon the rails; also with wrought iron hoops surrounding the projecting ends of the nave, to prevent splitting. The wrought iron tires and hoops are applied in the usual manner when hot, that they may shrink on the cast iron in cooling, and bind the same very tight; the outsides of the tires are turned true, and the central holes through the naves are bored truly cylindrical. The ends of the hollow centre axis are turned true on the outsides, to fit tight into the holes through the wheels; and when inserted they are secured by driving in a key, which is fitted into a hole previously cut in the joint, so that one half of the thickness of the key lodges in the cast iron nave, and the other half in the wrought iron hollow axis—see w, fig. 5. The extreme ends of the hollow axis conform with the flat surfaces of the naves of the wheels, in order that the flat surfaces of the rings 6, with their leather washers, may apply to both.

Fig. 5.



The hollow axis is made of wrought iron,

welded in the manner of gun barrels; an extra thickness is given at each end, where it is to be fitted into the wheels. The inside of the hollow is bored out truly cylindrical at each end, where the bearing parts, 3 3, of the solid axis, are to fit into it; those parts are turned truly cylindrical, and may be case hardened, as well as the interior of the hollow axis at the bearing parts, and also the projecting central parts of the ring 6. Note.—These projecting parts enter so far into the hollow axle as to leave very small vacant spaces between them and the shoulders of the central axis, and to allow about a quarter of an inch end play to the wheels along the solid axis.

Many of the parts hereinbefore described, admit of being differently constructed, without any departure from my invention. Wheels of wood, with cast iron naves, may be substituted for those represented in the drawing. The hollow axis may be made of cast iron, if a suitable increase of metal is given to make up the same strength. The ends where the bearing parts of the solid axis are to fit into the ends of the hollow axis, may be lined with brass, or with bell metal, inserted and fixed in. The ends of the solid axis may be fitted into its socket v, so as to be at liberty to turn freely round therein, instead of being held fast, as before described. The use of that will be that the axle may turn round with the wheels, in case it has been neglected to give a due supply of oil to the hollow axis, before setting out on a journey; and that in consequence the fitting parts thereof become bound together during a journey. A narrow groove may be cut in the cylindrical surface of each of the bearing parts of the solid axis, winding spirally round the same, in order to assist in conveying the oil to all parts of the length of the bearing.

Having now described my said invention, I do hereby declare, that what I claim as my improvement in the axles and parts which form the bearings at the centres of wheels for carriages which are to travel upon edge rail-ways, is the combination hereinbefore described, of those parts which are marked in the drawing, with numeral characters for reference in the foregoing description. That combination being made for the purpose of causing the bearings of the solid axis, (which does not turn round,) to press downwards into the concavities of the hollow axis, which does turn round with the wheels; and which hollow axis connects the two wheels together, so that one cannot turn round without the other. And I make no claim to the said improvement, except in its application to carriages which are to travel upon edge rail-ways.

In witness whereof, &c. [*Rep. Pat. Inv.*

Specification of a patent granted to GEORGE STEPHENSON, *of Liverpool, engineer, for an improved mode of making wheels for Rail-way carriages. Dated April* 30, 1831.

To all whom these presents shall come, &c. &c.—*Now know ye,* that in compliance with the said proviso, I, the said George Stephen-

son, do hereby declare, that my said invention is described and ascertained in manner following, (that is to say):—

My said improved mode of making wheels for rail-way carriages, consists in forming the same with a suitable number of hollow tubes of thin wrought iron to form the spokes, arms, or radii of such wheels; which tubes after being prepared at their ends (in the manner hereinafter described,) with borax, to serve as a flux to the wrought iron, are laid in proper radiating directions, into a mould formed of sand, in a suitable manner, to receive melted cast iron; which cast iron being poured into the central cavity of the said sand mould, will surround and attach to the inner ends of all the wrought iron tubular spokes, at the parts where the said preparation of borax has been previously applied thereto, and thus a nave or centre piece of cast iron, will be formed for the weel; and also melted cast iron being poured into the other cavities of the said sand mould, will surround, and attach to the outer ends of the same spokes, at the parts previously prepared with borax; and thus the circular rim or felly of the wheel will be formed in cast iron: and that felly is afterwards to be surrounded with a strong wrought iron tire or hoop which is applied when hot, around the cold cast iron, so that it may shrink or contract thereon in cooling, in order to firmly unite and bind all the parts of the wheel together: and lastly, the outer edge of the said tire must be suitably turned and formed to run on the rail-way.

And whereas, wheels for rail-way carriages have been commonly made under a patent granted to William Losh and myself, in the year 1816, with spokes of wrought iron of various forms, (but not hollow tubes,) and with cast iron naves and rims formed and united to the ends of the said wrought iron spokes, by running melted cast iron into suitable moulds formed of sand, the said cast iron surrounding and attaching to the ends of the said wrought iron arms, but without any previous preparation for those ends, with borax to serve as a flux; and also the wheels as formed, have of late been hooped with wrought iron tire.

I do hereby declare, that I confine my claim of invention under the present patent, (for my improved mode of making such wheels for rail-way carriages,) to the substitution of hollow tubes of wrought iron for spokes, in lieu of the solid bars of wrought iron heretofore used for spokes, and to the application of a preparation of borax as a flux, (in the manner hereinafter described,) to the ends of such hollow tubular spokes, previously to placing them in the sand mould, and to running the cast iron round them. The said hollow tubes for spokes, at the same time that they are stronger in proportion to their weight than solid bars for spokes, will hold more securely in the cast iron of the nave, and of the rim, because the cast iron running into the hollows at the ends of the tubes, as well as around the outsides of the tubes, obtains a much greater surface of contact with the wrought iron, than heretofore obtained with solid arms; and also the end of each wrought iron tube being an extended surface of thin metal, that metal becomes very highly heated by the melted cast iron, when the same is poured into the mould, and flows round the thin

wrought iron on both sides, (namely, inside and outside of the end of the tube:) and in consequence of the previous application of borax to the said ends of the tubes, both inside and outside thereof, the borax acting as a flux to the wrought iron, the heat of the melted cast iron causes the same to unite and adhere very firmly to the wrought iron; and hence, by my improved mode, very strong wheels can be made for rail-way carriages, which strong wheels have hitherto been a desideratum for carriages, to convey passengers and goods with that great rapidity of motion which is practised in travelling on the rail-way between Liverpool and Manchester; for the violence to which the wheels of the carriages are subjected in such quick travelling, is so great that no wheels hitherto tried on that rail-way have been found sufficiently safe and durable.

Wheels of cast iron, with wrought iron tires, are found liable to crack and to fly in pieces without any warning, and hence are dangerous for passengers; and wheels made with solid arms of wrought iron, with naves and rims of cast iron, run around the ends of wrought iron arms, (without the aid of borax as a flux:) but, according to the patent granted to Mr. Losh and myself in 1816, although hooped on the outside with wrought iron tires, are found very liable to work loose at the junctions of the wrought and cast iron; and hence, wheels with cast iron naves and wooden spokes and fellies, surrounded with wrought iron tires, have been preferred for the carriages to convey passengers on the aforesaid rail-way; but such wooden wheels wear out very fast, and require continual repairs; and wheels made according to my improved mode, will be found more durable and safe.

And for the more full explanation of my said improved mode of making weeels for rail-way carriages, I have hereunto annexed a drawing, representing two wheels which are made according to that mode.

Description of the drawing.

Fig. 1.

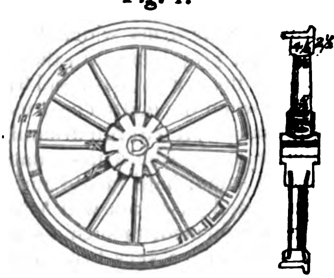
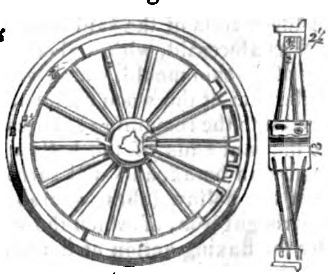


Fig. 2.



The wheels in figs. 1 and 2 have twelve hollow spokes of thin wrought iron, each one being made by turning up a piece of iron plate, of a suitable shape, size and thickness, into the form of a tapering flattened tube, with overlapping edges, which edges are welded together on a mandril, in the same manner as gun barrels are made, except that the tubes are of a flattened oval form, as well as tapering, as

is clearly shown in the drawing. The said tubes are enlarged a little at each end, in the form of a trumpet, or bell mouths, and are prepared for casting the cast iron naves and rim around the ends of them, by carefully cleaning the ends inside and outside from all dirt and loose scales, and then applying a thin glazing of borax to those ends, either by dipping the ends of each tube in water, and sprinkling the wetted parts with powder or dust of pounded borax, so as to cover the surface of the iron, inside and outside of the tubes with borax, nearly as far as the cast iron is intended to join to the wrought iron; and the said ends so covered with powdered borax, are then to be heated by holding them in the flame of an oven or hollow fire, until the borax becomes fused, and flows upon the surface of the wrought iron, so as to cover the same with a thin glazing or coat of borax; or otherwise, borax may be melted in a suitable crucible or pot: and the aforesaid ends of the tubes being heated and dipped into the melted borax, will become covered with a thin glazing or coating of borax, as aforesaid. Note.—The hollows of the said tubular spokes should be filled up with sand, except at so much of the ends thereof as are intended to have the cast iron run into the said hollows; and likewise one or two small holes should be previously drilled through the iron of each of the oval tapering tubes, in order to let out the air which might otherwise become confined within the hollows thereof, when the cast iron is run around their two ends.

The mould for casting the iron nave and rim, is formed by the aid of a wooden pattern or model, of the same size and shape as the intended wheel, with its central nave, arms and rim complete; the pattern being made in two or more thicknesses, which separate or take apart, as may be requisite: and the mould being formed of sand, rammed hard into two boxes, which separate and take apart in the usual manner practised by iron founders for casting wheels in sand, with moulding boxes and wood patterns; and when the pattern is withdrawn from the sand, leaving the cavity or mould therein, the hollow tubular arms of wrought iron, (prepared as aforesaid,) are laid into those cavities of the mould, which were left by the arms of the wood pattern, with those ends of the said hollow iron tubular arms which are prepared as aforesaid, with a glazing of borax, projecting into those cavities of the said mould, which were left by the central nave and by the circular rim of the wood pattern, so that when the melted cast iron is poured into the remaining cavities of the mould, it will run around and into the said ends of the hollow tubular arms, where the same are glazed with borax, and will surround the same, both inside and outside of the hollow tubes, whereby the melted cast iron will heat the thin wrought iron, of which those tubes are formed, to such a degree, as by the fluxing action of the borax, will cause a very firm union to take place between the ends of the wrought iron tubes, which form the arms of the wheel, and the cast iron which forms the central nave and the circular rim thereof.

Figs. 3 and 4 of the drawing represent another wheel, made according to my said improved mode.

The arms or spokes, which are fourteen in number, are cylindrical

tubes of wrought iron, instead of tapering flattened tubes; and they are not situated in a plane, but one half of the number are dished towards one side of the wheel, and the intermediate seven spokes are dished towards the other side of the wheel, to give greater lateral strength thereto. In every other respect the construction of this wheel is the same as that of figs. 1 and 2.

Note.—It will be necessary to insert three cores of dry sand across that cavity of the said mould which is left for casting the circular rim of the wheel, whereby the said rim, when cast, will be formed in three distinct segments, with small intervals between the ends of them, in order to allow for that contraction of the cast iron which must take place, in cooling, from a fluid state, till it becomes cold.

The intervals between the said three segments are afterwards filled up with iron keys, accurately fitted therein, and they may be fastened by riveting, if necessary; and thus a wheel with a firm circular rim is formed; and around that wheel, the wrought iron hoop or tire is applied when hot, that it may contract or shrink, and fasten upon the cast iron rim in cooling.

Note.—The cast iron rim of the wheel may be cast hollow, as represented in the section, by placing dry sand cores in the mould in proper positions, to occupy the middle part of the cavity left by the circular rim of the pattern, according to the mode usually practised by founders in like cases.

It is needless to enter into any farther description of the mode of moulding, or casting such wheels, because all competent iron founders are accustomed to such operations; and because my improved mode of making wheels for rail-way carriages, consists merely in the use of hollow wrought iron tubes for the spokes of such wheels, and in preparing the ends of such hollow tubes with a glazing of melted borax, applied inside and outside, at all the parts which are intended to join to the cast iron, in order that the borax may act as a flux to the wrought iron, to cause it to unite firmly to the cast iron, which is run or cast around the ends of the said hollow spokes, to form the central nave and the circular rim of the wheel. The dimensions of the wheels represented in the drawing, may be found by measuring from the scale; they are five feet diameter, and are adapted for the wheels of a locomotive steam engine, which weighs eight tons; the wheels being turned round by the power of the engine, in order to advance the engine along the rail-way. Wheels for other kinds of rail-way carriages may be made according to the same drawings, by apportioning their dimensions to the purpose for which they are intended, and with strength corresponding to the load they are required to carry.

In witness whereof, &c. [*Ib.*

Patent granted to THOMAS COLEMAN, *of St. Albans, in the county of Hertfordshire, training groom, for an improved roller for horses. Dated March* 29, 1831.

THE dangerous consequences resulting from tight lacing, so frequently insisted upon by our medical men, and so little heeded by

the fair objects of their solicitude, have, at all events, produced one benefit—that of releasing one of the most elegant, attached, and useful creatures under heaven, (woman excepted—when she has a waist of natural dimensions,) from the like pernicious treatment.

Mr. Coleman, being a rational person, and a man of observation, has discovered that the rollers in common use for horses, (for those more especially that are required to exert their speed,) being formed of a stubborn, unyielding material, have the effect of compressing the ribs, consequently of contracting the room in which the lungs perform their function, and, in the end, of rendering the animals liable to be injured in their wind.

The earlier in life these rollers are girded on—and very young colts, when they are of gentle blood, as with young ladies of the like heraldic standing, are submitted to the discipline—the more easily, of course, is the injury incurred. To obviate which, our patentee proposes providing the rollers for the horse cloths with elastic springs, flat in form, of hardened steel, upon a similar principle to elastic garters or braces. This improvement, he says, will answer all the purpose required, of confining the body cloth, at the same time that it will allow full liberty of action to the young animal's lungs.

[*Ib.*

Patent granted to THOMAS WESTRUP *and* WILLIAM GIBBINS, *both of Bromley, in the county of Middlesex, gentlemen, for improvements in converting salt or other water into pure or other water. Dated May* 24, 1831.

THE "improvement" to which these patentees lay claim, consists—first, in encircling the usual boiler appended to a ship's cooking apparatus, with another boiler destined to contain the salt or impure water which it is desirable to convert into pure liquid, fit for culinary or other domestic purposes. The steam arising from this passes through a worm pipe that is enclosed in a cylinder, situated between the decks of the ship, and *below* the water line. In the upper and lower parts of this cylinder are tubes communicating with the external water. As, therefore, it is the property of heat to ascend, the lower pipe will constantly receive a stream of cold water, while the heated water will pass out through the upper tube. The reader need not be informed that the condensed steam in the worm pipe, passes through the bottom of the cylinder into a receiver.

The patentees have added a more simple and economical mode than the above, of condensing the steam; which consists in passing the condensing pipe over the bows of the vessel by the side of the keel, (where it will be at little risk of injury from contusion,) and re-introducing it at a convenient distance below the water line.

Having thus described the principle of the patent, it is unnecessary to add, that so long as there is a fire in the kitchen range, and water in the boiler, no other labour or attention is requisite for the purpose of obtaining a constant supply of that purest of all liquids, distilled water. [*Ib.*

FRENCH PATENTS.

Patent granted to Messrs. Victor Fougere, *Bronze Manufacturer,* Herard de Villieres, *Varnish Maker, and* Emanuel Meunier, *all of Paris, for a decoration upon Brass,* Manheim, *or Gilding; imitating Mother-o'-Pearl, burnished Gold, dead or bright Silver, &c.*

The instructions for preparing the above decorations are, to take a plate of brass, copper or *manheim*, bite it with aquafortis, then burnish, and afterwards cover it with what is known in the trade under the name of common or simple varnish (*petit varnis:*) add to this liquid $\frac{1}{10}$th of copal varnish, and $\frac{1}{20}$th of essence of distilled turpentine. When the plate is thus overlaid, it is dried in the air for two or three days, and bitten until the bright metal not decorated, becomes dead. When the brass is thus prepared, it is silvered with the following preparation:—

Composition for silvering unpolished brass, and mode of using it.

Dissolve in a pound of aquafortis an ounce of virgin silver: when it is thoroughly dissolved, it is precipitated with a quarter of a pound of fine salt, dissolved in a half pint of water. The residue of this precipitation is washed in ten different waters, after which it is mixed with two lbs. of cream of tartar, and two pounds of purified salt, and made into a paste slightly liquid. With this composition the brass is silvered, observing the neatest precision, and rubbing the plate with a fine linen until it be completely covered, and present a perfect dead surface.

The plate having been thus silvered, it is cleansed in fresh water and thoroughly dried; when the size is diluted with essence of turpentine till the metal becomes brilliant, after whioh it is covered with the composition known by the name of *English* varnish.

For an imitation of burnished gold in a bronze ground, the same preparatory steps already described, are taken. When the size is dry, it is bitten, and afterwards bronzed in the following manner:— A copper farthing is dissolved in an ounce of aquafortis: with this is mixed a gallon of vinegar, two drachms of salt of nitre; and with a hair pencil the plate is covered till the whole be equally bronzed; after which the size is diluted, and the varnish laid on, as already described.

Decoration of a bright or dead silver on a bronze ground.

The brass or copper plate is silvered dead or burnished, and decorated as has been already described. The silvered brass, not decorated, is reduced to the state of dead, or unpolished brass, by biting. It is then bronzed, diluted, and varnished as detailed above.

Decoration of brilliant silver on a dead ground of the same.

The brass or copper plate is silvered, burnished and decorated as

before described. When the decoration is dry, the plate is slightly bitten, and the dead, or unpolished character, is given to it as in the first description.

These decorations may be interlocated by colours of every description. [*Ib.*

Patent granted to Monsieur Bastier, *of Paris, for a process of culture, bleaching, and platting Straw, destined for the manufacture of Hats, from what is termed Italian Straw.*

Cultivation of the Plant which furnishes the Straw.

The plant which supplies the straw calculated to make the hats from what is termed Italian straw, is a species of wheat known in Tuscany under the name *Marzajolo grano gentile rosso*, (triticum asticum, trimenon;) however, any other species of wheat will answer the purpose, since all are but modifications of the same primitive plant from the culture of different soils, in different climates: all depends then upon the mode of cultivation, the choice of soil, upon its exposure, temperature, &c.

The ruling principle in this cultivation consists in making every thing bear, upon obtaining a frail, attenuated, and hunger-starved plant—in fact, to degenerate it: thus in the management of it, the object is to produce a precisely opposite result from the one commonly sought. The end of ordinary cultivation is to produce a strong plant, vigorous, and well seeded: in the present instance, the most feeble and meagre growth is the point of perfection, the grain not being a desideratum.

The soil then should be extremely poor and sandy; upon lofty elevations, and amid flints and pebbles, this wheat is most favourably produced.

The preparing of the ground is the same as for other descriptions of corn, with the exception that no manure is laid upon it. In Tuscany they till very lightly: the grain is sown in autumn or in spring, but more commonly in autumn, because the straw is reaped more early, and the preparation for the manufacture may be entered upon more promptly; for if the straw be laid by from year to year, it will not bleach so favourably. It is requisite to sow thickly, for the grain comes up, in consequence, more slenderly, and, of course, in more considerable quantities. It is unnecessary to allude to weeding, or the other duties requisite in agriculture.

As soon as the stalk has gained sufficient strength, which may be easily proved by breaking it, it is reaped. This moment varies between the blossoming of the grain and its full maturity, according to the quality of the seasons, soil, &c. The straw of the wheat that is suffered to ripen for seed, serves for the coarser description of hats. As the plant is naturally short, it is plucked up in order that its length may not be curtailed by cutting it with a sickle or scythe.

When the plants are gathered, they are collected in small sheafs of three or four handfuls, and allowed to remain as many days upon the ground: the dew assists in the bleaching: but if the weather threaten rain, they must be quickly housed, for if they be wetted, they will be spoiled, and rendered unserviceable for the purpose intended—at least in the manufacture of white hats.

This mode of cultivation is of course susceptible of many modifications, according to the nature of the soils, their situation, the temperature, climate, &c. it would be as tedious as useless to enter into detail on this head; the main points being laid down, they will be found sufficient for every one who possesses any experience in agriculture.

Making of the Hats.

The straw being gathered, it is requisite to separate that part which is to be employed in the manufacture of the hat, that is, the upper part, from the first knot to the ear. This operation it is less difficult to perform than to describe. When separated, it is collected into small bundles, and the process of bleaching commences, which is accomplished in the following manner:

The straw is put into a large wooden chest, until it be filled, with the exception of the centre, that is reserved for a chafing-dish, lighted: the lid of the chest is closed as closely as possible, and in this state it is suffered to remain three or four days. No metal must be used in the making of this chest.

The straw being bleached, it is picked and culled, in which operation the spoiled, rank, and too large stalks are rejected; and the different qualities of straw, to the number of sixty, according to their delicacy, are separated; and of these, sixty qualities of hats are manufactured.

When picked and sorted the platting commences. This art is easily learned, and need not be described. Suffice it to say, it differs not from the ordinary mode in the common straw hats. The platting is begun with five straw threads, and gradually increased to nine, until the whole of the bottom of the hat be finished, and thus they continue the whole. The platting being completed it is sowed, after previously cutting off the projecting straws. The sowing of the plats is made upon a form, of which they take the figure. The sewing, which should be managed so as not to expose the threads, is effected by passing the needle under the straws in the platting. The rim of the hat should be from time to time withdrawn during the sewing, to prevent its becoming distorted. It is commonly by the number of rows or plats composing the rim, that the fineness of the hat is distinguished; since this rim being of a settled dimension, the finer the plat, the more material is included in the plat. The straws that exceed the level of the plats are again clipped with scissors.

The hat being completed, it is polished, calendered, and bleached: before it is calendered, and after having been fumigated with sul-

phur, the straws which have too yellow a hue, or are otherwise defective, are removed: the vacancies also in the plats are filled up. The straws are removed by needles and scissors; and the vacancies are supplied by means of a needle threaded with a straw. The hats are smoothed with polishers, passing them uniformly the same way; which instruments are commonly made of box wood, of a wedge form, with a single handle, uniting at its base.

They are calendered with a long heated iron of about fifteen pounds weight, passing it also the same way over the plat.

The fumigation by sulphur is performed before the hats are either polished or calendered, and in the same chest in which they were first bleached; being previously slightly damped; and they are allowed to remain in the vapour from twenty-four to seventy-two hours. Finally, those of an inferior quality or colour are dyed black.—*Brevets d'Inventions.*

Patent granted to FRANCOIS DODEROT, *Embroiderer, Paris, for the employment, in embroidery, of transparent and opaque cuttings of Quills, of Tortoise-shell, and of Whale-bone.*

THIS invention consists in embroidering with spangles made of quill, tortoise-shell, and whale-bone, as they have hitherto been manufactured of steel. The above materials, varied under an infinity of different forms, and shaded in every colour, produce a more airy decoration, it is less liable to accident, and is more agreeable to the eye than any hitherto known.

Two improvements have been added to this invention; the one, that of rendering the quill of so brilliant a white as to resemble mother-o'-pearl; and the other, that of employing in the embroideries of gold and silver thread, thread of horse-hair and whale-bone.—*Ibid.*

A Dial, or Watch, for indicating the precise time of Observations. By Monsieur JACOB.

THE watch of Monsieur Jacob is composed, according to custom, of five wheels and a cylindrical escapement. It performs 18,000 vibrations in an hour; that is to say, five every second. The hand then makes five little leaps in each space between the divisions of the dial. The stay of the hand can act upon one only of these leaps, which limits the inaccuracy in the movement to less than a fifth of a second, a precision amply sufficient for the required purpose. When the machinery is to be set in motion, this is effected by pressing a button similar to that used in repeaters, the action of which may be stopped at pleasure, according to the will of the person making the observation. The arrested hand is then examined, and the second, with its fraction of stoppage, is noted: this fraction is obviously the place at which the stoppage was made, in dividing the whole space between

the two divisions into five parts, noting at the same time, that this limb should be centred and divided with great care, to prevent inaccuracy.

The observation being noted, to proceed to another, the pin is pressed with the finger to set the second hand in motion, and in an instant it is observed to hasten to regain its place. The inventor, the better to show the truth of this movement, has furnished another hand, which is not stopped with the former, in order that it may be perceived that this has in fact resumed its place and overtaken the other. This part of the mechanism consists in connecting with the small middle wheel a pinion of the same number as that of the seconds wheel, and in carrying the other moving hand upon the extension of the axis of this pinion, the centre of another seconds dial.—*Bull. de la Société d'encouragement.*

Machine for Dressing Cloth. *By* Monsieur Beauduin Kamenne.

The object of this machine is to obtain a greater degree of celerity in the napping of cloths, added to a greater perfection in the same operation, than that accomplished by any other mechanism. Although it is constructed upon the same principle as the machines already well known, it nevertheless varies from them in an essential degree, inasmuch as the teazels with which the cylinders are supplied, seize the cloth with double effect, and, consequently, give at the same moment two strokes for one.

In another particular also, not less important, it differs from the machines already in use, and that is, that it dispenses with the necessity of the workman's removing the teazles for the purpose of cleaning them; since that operation is effected spontaneously and incessantly, as the work itself proceeds, and without loss of time, by means of a second cylinder furnished with brushes, and revolving with great rapidity.

The advantages which this machine presents over those now in use, consist, first, in the cost of labour being diminished, and the produce being double that of the common machines: whence it results that half the time requisite for completing this department in the preparation of cloth, is economised. Second, in the economy of expense and time bestowed in cleaning, which was heretofore entrusted to children; moreover, in husbanding the teazles, whereby their duration is extended. Third, finally, in the force consumed, being much less than that of two common frames; the whole, at the same time, occupying the space of one frame only.—*Descript. des Brevets.*

On the Strength and Best Forms of Cast Iron Beams.

[Continued from p. 208.]

These experiments show very clearly that as the elasticity of the material is impaired by the weights applied to it, the deflections by extension and compression become unequal. We are thus prepared

to discuss the question whether the force required to destroy the elasticity of cast iron by tension, is equal to that which is required to effect the same result by compression.

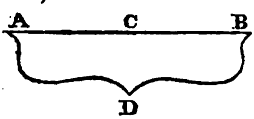
That a greater force is required to destroy the elasticity of cast iron by compression than by tension is shown by the following experiments.

"23. I took two castings, apparently precisely alike, whose dimensions in the section were the same as in the last experiment, (expt. 4,*) and placing the ends of each of them upon two props, four feet three inches asunder, broke them by weights in the middle, one with the broad part downwards thus (⊥), and the other with it upwards, (T).

The first bore 8¾ cwt. and broke with 9 cwt.

Deflection in the middle with 4 cwt. .6 inch.
" " " 8¼ " 1.8 "

"The weights were laid on very gently, and the casting showed no signs of approaching rupture, except a small increased deflection; but when it broke, a piece flew out whole from the compressed side, of the form below, where AB = 4 inches, and CD = .98 inches, the point D at the bottom being in or near to the neutral line. AB was in the direction of the length of the casting, and the weights were laid on at C. Hence since the depth of the casting was



1.35 (expt. 4,) CD $= \frac{.98}{1.35}$ depth $= \frac{5}{7}$ of it nearly.

"This experiment is interesting; it shows the situation of the neutral line, and may, from the peculiar form of the wedge, throw some additional light on the nature of the strain.

"The other casting bore 2¼ cwt. and broke with 2½ cwt.

"The strength of the castings was, therefore, as 8¾ to 2¼, or as 4 to 1 nearly, according as they were broken, one or the other way upwards.

"Those who suppose the strength to be bounded by the elasticity, and that the same force would destroy the elastic power, whether it tended to extend or compress the body, must have conceived these castings, and indeed those of every other form, to be equally strong, which ever way upwards they were turned. A conclusion which we see would lead to very erroneous results, if applied to measure the ultimate strength of cast iron."

At this stage of Mr. Hodgkinson's progress, he was rescued from the necessity of proceeding upon a small scale in his experiments, by the liberality of Messrs. Fairbairn and Lillie, who undertook to have the experiments made at their own expense, the castings being furnished from their own foundry.

"26. I felt desirous of making, on malleable iron, experiments

* Page 207.

similar to those already given on cast iron, and for this purpose a bar about six feet long was made. It was of the same form as those used in cast iron, its section being uniform throughout, and in the shape of a T, of which the top was five inches broad, and three-eighths of an inch thick, and the vertical part, or leg, one and one-eighth inch deep, and nearly one-fourth inch thick. In the experiments, one end was fixed horizontally and firmly wedged into an immoveable object, a large stack of pig iron, and weights were hung at three feet distance, where the deflections were taken. The experiments were made nearly in the same manner as those on cast iron; only here, we did not subject the same part to both tension and compression, but contiguous parts. Thus, suppose the first experiment was to extend the vertical rib, the next experiment would be to compress it in a part very near to the former place; the piece having been taken out of its fastenings, rendered straight if necessary, and fastened again, the other side upwards, by the part which was most strained before. This mode was used, turning and shifting the piece, throughout its whole length; and toward the conclusion of the experiments, the weights were increased till the vertical rib exhibited signs of being drawn out and crushed.

"27. The results from these experiments were anomalous, partly through defective fixing;* but they left no doubt that the extensions, and compressions, were nearly equal from the same forces, and that through their whole range: and therefore that forces not very unequal would have destroyed the piece, whether the rib was drawn out or crushed; a result very different from that which was obtained in cast iron.

"The mean results from the extensions and compressions, with the three greatest weights laid on, were as below—

Weights.	Deflections from extension.	Deflections from compression.
585	1.40	1.54
697	2.00	2.56
809	4.75	4.79"

To strengthen the inference from these results, our author quotes the experiments of M. Duleau upon the same subject. As the method pursued is ingenious, the subjoined translation of the quotation may be acceptable. (Essai Théorique et Expérimental sur la résistance du fer forgé.)

"A bar of wrought iron of square section, $\frac{4}{5}$ of an inch on a side, was bent, when cold, into the arc of a circle, two of its faces remaining plane. Upon these two faces lines had been drawn perpendicular to the axis of the bar, and one inch apart. The bar was bent in three different experiments in different degrees: in the first, for a length of arc of one foot the deflection was $\frac{7}{8}$ths of an inch, in the

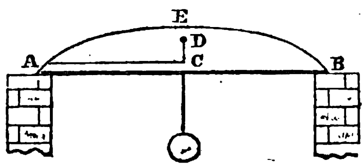
* This objection did not exist in the experiments on cast iron, for in those the castings were rendered utterly immoveable, by means of powerful screws.

second 1½ inch, and in the third 2⅜ of an inch. The lines drawn upon the plane faces remained straight, and the increase of length of the convex side was just equal to the diminution in length of the concave."

We follow the author into the second part of his inquiry; that having reference to the influence of form upon the strength of cast iron beams.

"29. The intention of the preceding experiments, on the elasticities of cast and wrought iron, being to prepare in some degree the way to an inquiry into the best form of beams of those metals, particularly of cast iron, we will now reconsider the strain which beams are subjected to, with a view to their proper formation to obtain the utmost strength. If, then, we conceive a beam, supported at its ends, and bent by a weight any where laid upon it, we have seen that all the bottom fibres, or parts, must be in a state of tension, and the top ones in a compressed state, and if C and D be the centres of tension and compression,* the forces in C will be just equal to those in D, where D may be considered as the fulcrum of the bent lever DCA.

Fig. 3.



"In order to increase the arm CD of the lever, and consequently the strength of the beam, the parts should be disposed as far asunder as possible.† This would perhaps be best effected by putting two strong ribs, one at top, the other at bottom, the intermediate part between the ribs being a thin sheet of metal to keep the ribs always at the same distance, and thereby to prevent derangement from irregular strains, as well as to serve another purpose, which will be mentioned further on.

"30. As to the comparative strength of these ribs, that appears to me to depend upon the nature of the material, and can only be derived from experiment. Thus, suppose it was found that it required the same force to destroy the elasticity of a piece of metal, whether the force acted by tension or compression. In this case, the top rib ought to be equal to the bottom one, supposing it was never intended to strain the beam so as to injure its elasticity. And if it were found that the same weight would be required to tear asunder or to crush a piece of metal, according as it acted one way or the other, the beam should have equal ribs to enable it to bear the most without breaking. Now, from the experiments given above, it appears that these qualities are in a great measure possessed by wrought iron; and therefore

* See our remarks, p. 205.

† Refer again to remarks, p. 205.

whether it was intended to strain a beam of it to the extent of its elasticity, or even to the breaking point, there ought to be equal ribs at top and bottom.

"31. If, however, the metal were of such a nature that a force, F, was needed to destroy its elasticity by stretching it, and another force, G, to do the same by compressing it, it is evident that the ribs ought to be to one another as F to G, in order that the beam might bear the most without injury to its elasticity. And if it took unequal weights, F′ and G′, to break the piece by tension and compression, the beam should have ribs, as F′ to G′, to bear the most without fracture.

"Our experiments on cast iron were not well adapted to show what relative forces would be required to destroy the elasticities; but it appears, by the experiments of Mr. Rennie, that it would take many times the force which would draw it asunder, to crush it. The bottom rib must then be several times as large as the top one to resist best an ultimate strain.

"32. This last matter must be considered with some modifications; it would not perhaps be proper to make the size of the ribs just in the ratio of the disruptive to the crushing forces, as the top rib would be so slender that it would be in danger of being broken by accidents.

"33. The thickness, too, of the middle part of the beam, or that between the ribs, is not a matter of choice; independent of the difficulty of casting, it cannot be rendered thin at pleasure, but must have a certain thickness, though in long beams the breaking weight is small, and a very small strength of middle is necessary.

"The neutral line being the boundary between two opposing forces, those of tension and compression, it seems probable that bending the beam would produce a tendency to separation at that place. Moreover, the tensile and compressive forces are, strictly speaking, not parallel; they are deflected from their parallelism by the action of the weight, which not only bends the beam, but tends to cut it across in the direction of the section of fracture; and this last tendency is resisted by all the particles in the section. Thus, in the figure 1,* the force of compression is not in the direction I*o* produced, but in a direction downwards, oblique to that. It is composed of the force in I*o* produced, and that part of the weight W, whose vertical effect is sustained by the lower part of the beam. This compounded force will then tend to separate the compressed part of the beam in the form of a wedge, and this tendency must be resisted by the strength of the part between the ribs, or flanges. We have already given one instance of fracture this way, and there will occur several others in the course of our experiments.

"34. We see then that there are three probable ways in which a beam might break, 1st, by tension, or tearing asunder the extended part; 2nd, by the separation of a wedge, as above; and 3d, by compression, or the crushing of the compressed part. I have not, however, obtained a fracture by this last mode in cast iron."

* See figure p. 204.

We deem it unnecessary to give the details of an experiment made upon a beam with flanges, in which the sum of the breadths of the upper and lower ribs were constant. Such a figure would be formed by placing a board upon one of its longitudinal edges, and nailing two triangular pieces to the two edges, the base of one triangle being opposed to the vertex of the other. The quantity of matter in every cross section of this beam would be the same. The results were not generally satisfactory, but one of them is worth noticing, namely, that the beams being supported at one end, and weights applied at different distances from the opposite end, fractures very frequently took place at a distance from the supporting shoulder, at the section where the breadth of the upper and lower flanges were just equal, this being, according to Tredgold, the *strongest section* of the beam.

"36. The indecisive character of these experiments, Mr. Ewart was of opinion might arise from their having been made on too small a scale, and he suggested to me the propriety of repeating them on a larger one: which was done, and the results show a degree of uniformity, which forms a striking contrast to the others. The mode, however, of making the experiments was varied; for, as I had met with difficulty in getting sufficiently good castings from the form of model before used, and as Messrs. Fairbairn and Lillie had a very convenient apparatus, a long lever, for trying or breaking beams, I felt rather more desirous of making the future experiments on small beams, since the results would be more useful in that form.

"37. The form we first adopted was one in which the arc AEB, (figure 3,*) was a semiellipse, and the bottom rib a straight line; but the sizes of the ribs at top and bottom were in various proportions; the ribs in the model were first made equal, and when a casting had been taken from it, a small portion was taken from the top rib and attached to the edge of the bottom one, so as to make the ribs as one to two; and when another casting had been obtained, a portion more was taken from the top, and attached to the bottom as before, and a casting made from it, the ribs being then as one to four.

"In these alterations the only change was in the ratio of the ribs, the depth and every other dimension in the model remaining the same.

"38. In most of the experiments the beams were intended to be broken by a weight at their middle, and, therefore, the form of the arc AEB was of less importance; in making them elliptical they were too strong near the ends for a load uniformly laid over them; the proper form is something between the ellipse and parabola. It is shown, by most of the writers on the strength of materials, that if the beam be of equal thickness throughout its depth, the curve should be an ellipse to enable it to support, with equal strength in every part, a uniform load; and if there be nothing but the rims, or the intermediate part be taken away, it is shown by Hutton in his Treatise on Bridges, or in my Paper, Manchester Trans. 1831, page 364, that

* See figure p. 264.

the curve of equilibrium, for a weight uniformly laid over it, is a parabola: when therefore the middle part is not wholly taken away, the curve is between the ellipse and parabola, and approaches more nearly to the latter, as the middle part is thinner. Mr. Tredgold states the proper form of the curve to be an ellipse.

"39. The instrument used in the experiments was a lever, about fifteen feet long, placed horizontally, one end of which turned on a pivot in a wall, and the weights were hung near to the other; the beams being placed between them and the wall. In the first seventeen experiments, the beams were placed at three feet distance from the pivot in the wall, and in the other experiments, at two feet, except otherwise mentioned.

"All the beams in the twenty-two experiments immediately following each other, were exactly five and one-eighth inches deep in the middle, and five feet long, and were supported on props just four feet six inches asunder. The lever was placed at the middle of the beam, and rested on a saddle, which was supported equally by the top of the beam and the bottom rib, and terminated in an arris at its top, where the lever was applied. The deflections were taken in inches and decimal parts, at or near the middle of the beam, as mentioned afterwards. The weights given below are the whole pressure, both from the lever and the weights laid on, when reduced to the point of application on the beam. The dimensions of section in each experiment were obtained from a careful admeasurement of the beam itself at the place of fracture, which was always very near, (usually within half an inch of,) the middle of the beam, the depth of the section being supposed to be that of the middle of the beam, or five and one-eighth inches.

"As the experiments were made at different times, and there might be some variation in the iron, though it was intended always to be the same, a beam of the same length and depth as the others, but of the common form, always from the same model, was cast with each set of castings for the sake of comparison.

"40. The first six beams in the first series were cast *horizontal*, that is, each beam lay flat on its side in the sand; all the rest were cast *erect*, that is, each beam lay in the sand, in the same posture as when it was afterwards loaded, except that the casting was turned upside down when in the sand.

"In all the experiments, the area of the section was obtained with the greatest care; it includes, besides the parts of which the dimensions are given, the area of the small angular portions at the junction of the top and bottom ribs with the vertical part between them.

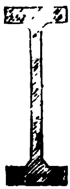
"41. The principal objects proposed in the experiments were: first to seek, directed by theory, the form of section, in which a cast iron beam would be the strongest, up to the time of fracture, its length and depth being given: next, to obtain, if possible, a general rule for the strength of such a beam then, since the rules given in the commencement of this paper,* only apply, in cast iron, so long as the elasticity is perfect."

* Those deduced by the author from theoretical considerations, sketched at the beginning of our remarks. See notes p. 205.

The nature of our work would render it inexpedient to extract the details of the thirty-six laboured experiments given by the author. We must content ourselves to give specimens of his mode of experimenting, and then present his deductions to the reader.

I. EXPERIMENT.

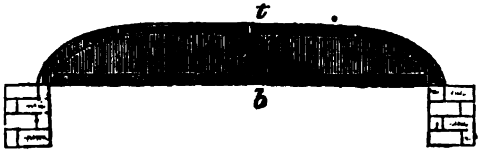
"Beam with equal rib at top and bottom.
Dist. between supports 4 feet 6 inches. Depth of beam $5\frac{1}{8}$ inches.



Dimensions of cross section, at place of fracture, in inches and parts.

Area of top rib $= 1.75 \times .42 = .735$
Area of bottom rib $= 1.77 \times .39 = .690$
Thickness of vertical part between the ribs, $= .29$

Area of above section = 2.82 inches.
Weight of casting = $36\frac{1}{4}$ lbs.
Breaking weight 6678 lbs. = 59 cwt. 70 lbs.



"The form of fracture is represented by the line $b\,n\,r\,t$, where $t\,r = .6$, and $b\,n = 2.5$, the figure being a side view of the beam.

"To find the strength per inch of cross section, we have, dividing the breaking weight by the area, $\frac{6678}{2.82} = 2368$ lbs. per inch. This quantity in each beam may be taken as an index of its strength, and we shall use it to compare together the strengths of those beams that are of the same length and depth, which is the case in the first twenty-two experiments.

"Comparing this with the result from expt. 4, where the beam bore 2584 lbs. per inch, gives $2584 - 2386 = 216 =$ defect.

"$\therefore$ Loss in strength $= \frac{216}{2584} = .083$ or $\frac{1}{12}$ nearly, in parts of what the common beam bore.

"The form of section above is essentially what Mr. Tredgold has represented to be, that of the strongest beam, while the elasticity is perfect—our future experiments will render it probable that it is in this respect nearly as defective as it is in its ultimate strength."

The second experiment was with a beam in which the areas of the section of the top and bottom rib were as one to two. Strength per

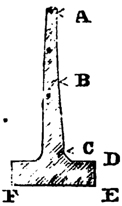
square inch of section 2567 lbs. In the third the areas of the top and bottom rib were as one to four. The strength 2737 lbs. per square inch.

We subjoin the details of the fourth, fifth, and sixth experiments.

IV. EXPERIMENT.

"Beam cast in common form from Messrs. Fairbairn and Lillie's model.

Distance between supports and depth of beam as before.



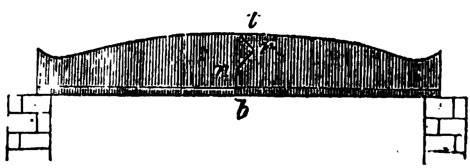
Dimensions of section in inches.

Thickness at A = .32
" " B = .44
" " C = .47
FE = 2.27
DE = .52

Area of section = 3.2 inches.
Weight of casting = 40½ lbs.
Deflection with 5758 lbs. .25 inches.
" " 7138 " .37 "
Breaking weight = 8270 lbs.

"The beam twisted a little before breaking: this, however, was not usually the case in the other beams from the same model.

"Form of fracture as in figure, *tr* = .75.



"Hence strength per inch of section $= \frac{8270}{3.2} =$ 2584 lbs.

V. EXPERIMENT.

"This casting had its top rib a parabolic arch, and the top and bottom ribs nearly equal in section, with equidistant ordinates only between them.

Distance between supports and depth of beam as before.

Dimensions of ribs in inches.

Area of top rib = 2.2 × .56 = 1.23
Area of bottom rib = 2.2 × .53 = 1.17
Weight of casting = 41½ lbs.
Breaking weight = 5528 lbs. or less: see next exp't.

"This weight, however, is but two-thirds of what was borne by the common beam in the last experiment.

"It broke by separating near the first ordinate, as in the figure, the top part remaining whole; the weight having been removed as soon as the fracture commenced.

"This is represented by Mr. Tredgold, 'Essay on Strength of Cast Iron,' to be a very economical form of beam. It would, there is little doubt, have resisted much more tenaciously if the weights had been laid uniformly over it; but this experiment shows the great weakness of the beam when the weight is applied at a single point, and therefore the danger of using it in practice.

VI. EXPERIMENT.

"A parabolic arch, differing from the last only in its having a portion taken from the top rib and added to the bottom, leaving the height as before, and the ratio of the ribs one to two nearly.

Distance between supports and depth as before.

Dimensions in section of the ribs.

Area of top rib $= 2.2 \times .36 = 0.79$ inches.
Area of bottom rib $= 2.2 \times .75 = 1.65$ "

Weight of casting = 43 lbs.
Breaking weight = 5528 lbs.

"It broke quite off in the same place as the last did.

"Both this casting and the preceding one broke with the first weight laid on them, 5528 lbs., and probably would have done so, particularly the former, with several hundred weight less. The latter casting was doubtless the stronger, as it had more matter in the bottom rib, and they both broke by tension, or by drawing asunder the bottom part: which had indeed been the case with every beam we had tried.

"All the preceding experiments were made on beams cast on their side, from iron, of which the following is a description.

Mixture.

$\frac{1}{3}$ of Blaina, No. 2, } Welsh.
$\frac{1}{3}$ of Blaina, No. 3, }
$\frac{1}{3}$ of W S S, No. 3, Shropshire.

"This mixture is a strong iron, and therefore well suited for beams."

In the seventh experiment a beam cast *erect*, but upside down from the same model as in the fourth experiment, and under a superior head of metal, bore 3188 lbs. per square inch.

Experiment 8th was with a beam modelled as in experiment 3d, but the area of section of the top rib to that of the bottom as 1 to $3\frac{1}{2}$;

strength 2683 lbs. This beam was cast, by mistake, with the broad rib lowest.

Experiment 9th. In this was used the model of the last experiment with one inch in breadth added to the bottom rib. Ratio of the areas of top and bottom rib as 1 to 4¼ nearly. Strength 3183 lbs. Gain in strength over beam of experiment 10, nearly one-seventh.

"*Remark.*—Though this beam had a larger bottom rib, it still broke by tension, or by tearing asunder the bottom part first, as was evident since it had neither been crushed nor broke by a wedge, (Art. 34;) this I had noticed to be the case in every experiment, (see expt. 6.) There had been one-seventh gained in strength, above that of the common beam,* by the addition already made, and it was probable, we might add still more to the lower rib without danger of fracture by compression; for in no case, except of the common beam, which sometimes twisted a little before it broke, had there been the slightest appearance of over compression. This idea will be pursued in our future experiments."

"Experiment 10. Common beam cast upside down, in the usual manner. This, like the rest, was from the same model as that in experiment 4." Strength 2792 lbs.

"In the following experiments, the bottom rib is considerably increased, agreeably to the remarks made on experiment 9, but for fear lest the top rib should be overpowered, and by its compression the point of support thrown lower down the beam, and consequently the beam weakened, the top rib was a little strengthened likewise.

"The bottom rib will continue to be increased by small degrees, till such time as the beam breaks by compression, or by the separation of a wedge; at which point perhaps, we shall have arrived at nearly the strongest form of section, for the same depth of beam and quantity of section."

[TO BE CONTINUED.]

On the Friction and Resistance of Fluids. By George Rennie, Esq. *V. P. R. S.*

Read before the Royal Society, June, 1831.

When on a former occasion I communicated the results of a series of experiments on the friction and resistance of the surfaces of solids, (Philosophical Transactions for 1828,) I stated that they formed part only of a series of experiments on the nature of friction generally. My object at first was to trace the relation subsisting between the retardation produced by the surfaces of solids in motion when in contact with each other and with fluids; but finding that the subject connected with either of these branches was sufficiently extensive, I

* See experiment 10 which follows.

deemed it necessary to postpone the second part of the inquiry to a future occasion. Those experiments, however, established some important facts. They showed that (within the limits of abrasion,) friction was the same for all solids, and that it was neither affected by surface nor velocity. Subsequent experiments upon rolling bodies of great weight and magnitude, when the resistance was reduced one-thousandth part of the mass, and the surfaces in the ratio of thirteen to one, have corroborated the affinity of resistance between rolling and sliding bodies. Thus in connecting and continuing the isolated experiments of Coulomb and Vince, and assigning values to the abrasive resistances of most of the most useful solids, a considerable advance has been made in the science.

The subject of the present paper, however, involves difficulties of a more complicated kind. The theory of solids as deduced from the laws of mechanics, and independent of experiment, may be applied to any system of bodies; but the theory of fluids, in which the form and the disposition of the particles, or the laws of their action, are unknown, must necessarily be founded on experiment; and even with this aid, which can only be obtained through the intervention of a solid, our knowledge of the true properties of fluids must be vague and uncertain. Accordingly we find that the subject of fluids attracted the attention of some of the most distinguished mathematicians and philosophers of Europe for the last two centuries; that is, from the year 1628, when Castelli first published his treatise on the measure of running water, down to the hydraulic investigations of Eytelwein and Young. Between these periods, Italy, France, Germany and England, added their contributions to the science. But it is to the Italians principally that we owe the foundation of it, in their numerous investigations and controversies on the rivers of Italy; hence the writings of Castelli, Viviani, Zendrini, Manfredi, Polini, Frisi, Gulielmini, Lechi, Michellotti, and of many others.

Each of them has endeavoured to establish a theory applicable to rivers and torrents, but in general with indifferent success. The science again received fresh accessions from the more valuable investigations of Bossut, Dubuat, Venturi, Funck, Brunning, Bidone, Coulomb, Prony, Eytelwein and Girard; and among our own countrymen, of M'Claurin, Vince, Matthew Young, Dr. Jurin, Professor Robinson, and the late Dr. Thomas Young. Sir Isaac Newton had already demonstrated, in his celebrated propositions, 51, 52, and 53, of the Principia, (in the case of a cylinder in motion immersed in a fluid,) that the resistance arising from the want of a perfect lubricity in fluids is (cæteris paribus,) proportional to the velocity with which the parts of a fluid separated from each other; and that, if a solid cylinder of infinite length revolves with a uniform motion round a fixed axis, in a uniform and infinite fluid, the periodical times of the parts of the fluid thus put in motion will be proportional to their distances from the axis. This theory (although conformable to experiment,) was objected to by Bernoulli and D'Alembert, on the ground that Sir Isaac Newton had not taken into consideration the centrifugal force or friction arising from the pressure of the concentric rings

of filaments round the cylinder, the fluid being supposed in a state of permanence, and the friction of the rings equal throughout.

Pitot (1728,) in his experiments on the water works at Marly and Versailles, was the first to demonstrate with equal velocities, and in the ratio of the volume of water, the friction of water in pipes was in the inverse ratio of their diameters; and Couplet, (1733,) Mariotte, and Deparcieux, estimated the difference between the real and calculated expenditures of glass tubes and pipes.

Chezy (in 1771 and 1786,) was the first engineer who endeavoured to establish the relation subsisting between the inclination of an aqueduct and the transverse section of the volume of water it ought to carry—on the supposition that the accelerating force, due to the inclination of the bed of the conduit, is counterbalanced by the resistances of the channel in the ratio of the surface, and increasing in proportion to the square of the velocity. What Chezy had remarked was concluded by Bossut, who cleared the investigation of most of its difficulties, and demonstrated it to be in accordance with theory. He found that small orifices discharged less water in proportion than great ones on account of friction; that the vena contracta, and consequent expenditure, diminished with the height of the reservoir; he pointed out the law by which the discharge diminishes according to the inclination and number of bends in a pipe, and the influence of friction in retarding the velocity of waters moving in canals and pipes, in which he made the square of the velocity to be in the inverse ratio of the length of the pipe; he determined the co-efficients by experiment, and thus obtained a formula expressive of the conditions of the uniform motion of water in open canals. The greater part of these hypotheses may be said to have been removed by the more extensive researches of Dubuat. His great hydraulic work, published in 1779 and 1786, contains a series of the most valuable observations, whose results accord very nearly with the new formula of the motion of water in pipes and open conduits; and his experiments, with pipes inclined in various angles from the 40,000th part of a right angle to 90 degrees, and in channels which varied from a line and a half in diameter to areas of seven or eight square toises, seem to comprehend every case of inclination; so that by collecting a prodigious number of facts, both with compressible and incompressible fluids, he obtained a general expression for all cases relative to the friction and cohesion of fluids: but a logarithmic function which he introduces in it, by a sort of approximation, gives it a character of uncertainty, which restrains its use, and shows the necessity of fresh researches. Ventruri, in 1798, "Sur la Communication latérale du Mouvemens dans les Fluides," repeated and added many new facts to the experiments of Bossut, on the expenditure of differently shaped orifices and tubes, but particularly on the lateral communication of motion by the cohesion of fluids. Coulomb first approximated to the solution of the question, by a very ingenious apparatus, consisting of discs of different sizes, fixed by their centres to the lower extremity of a brass wire, and made to oscillate in fluids by the force of torsion only: he concluded that the resistance was a function, composed of

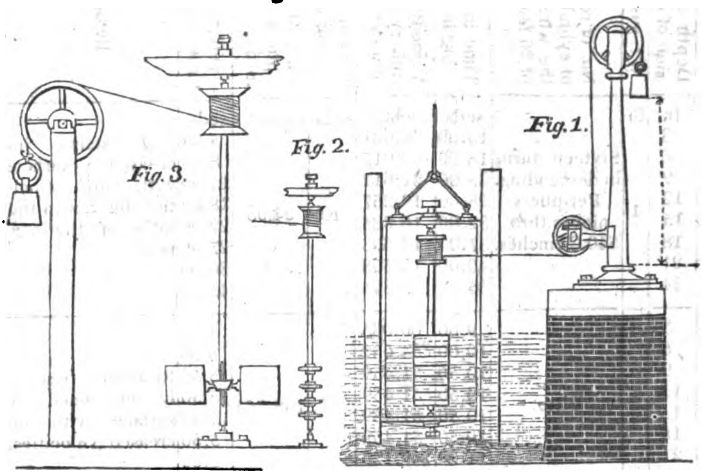
two terms, one proportional to the first, the other to the second powers of the resistance: again, that it was not sensibly increased by increasing the height of the fluid, but simply by the cohesion of the particles of the fluid which presented greater or less resistance, in proportion to the viscidity of the fluid, oil being to water in the ratio of 17.5 to 1. But whatever might be the conclusions of Coulomb, it is obvious that both the size and construction of his apparatus were ill calculated to produce results whereon to found a satisfactory theory; and accordingly both Messrs. Prony and Girard, in expressing their formulæ of resistance, have not admitted that of Coulomb, but have adopted the mean of the best of experiments made by other authors: but as these formulæ give only the mean velocity, which is much greater than the velocity (of the fluid contiguous to the pipe,) which ought alone to enter into the expression of the retarding force, it follows that the co-efficients deduced from the mean of all the experiments adopted by these gentlemen, have a value greatly inferior to the motion of the fluid contiguous to the side of the pipe or conduit. To ascertain correctly the value of this kind of resistance, M. Girard, (vide les Mémoires des Scavans etrangers for 1815,) undertook a prodigious number of experiments on tubes of different diameters and length, from which he deduced that the retardation is as the velocity simply. The effects of temperature are very remarkable: if the velocity be expressed by 10, when the temperature is 0° centrigrade thermometer, the velocity will be 42°, or increased four times when the temperature is 85°: these values must be deemed approximations only.

The contributions of British philosophers towards the improvement of this science have been, unfortunately, scanty; for, with the exception of Sir Isaac Newton, (who led the way,) Dr. Jurin, Dr. Matthew Young, Dr. Desaguliers, Dr. Vince, Mr. Smeaton, Mr. Banks, and the late Dr. Thomas Young, (see the paper of the latter gentleman in the Philosophical Transactions, and his commentaries on Eytelwein's experiments,) we can scarcely find any experiments on the subject; whatever has been effected by our engineers or scientific men, has either been withheld from the public, or consigned to obscurity; and though we have tracts of marshes and fen land, consisting of many thousand acres, the dissertations on the mode of draining and carrying off their superfluous waters are confined to local pamphlets and reports, of comparatively minor interest to the science of hydraulics.

From the foregoing short but imperfect history, it is obvious that much has been done towards perfecting this science. It is however certain, that much yet remains to be accomplished; and although we are deeply indebted to both the French and English philosophers for their extensive investigations on the laws of capillary attraction, the descents of globes in fluids, and the adhesion of fluids to metal discs, the phenomena of fluidity, and the laws which govern the motion and equilibrium of their particles, must yet remain a problem purely geometrical; and as we possess no tangible means of approximating to the solution of the problem, but through the intervention of a solid,

we must content ourselves, in like manner, with the imperfect formulæ deduced from experiments made on a small scale on the friction and adhesion of water in pipes and conduits, until we can ascertain more correctly the causes of the retardations of rivers as they occur in nature.

In the consideration of this question, I propose to examine, first, the retardations of the surfaces of solids moving in fluids at rest; secondly, the retardations of fluids over solids; and, thirdly, the direct resistance of solids revolving in fluids at rest.



To illustrate the first case, I caused an apparatus to be constructed, of which Fig. 1 in the annexed drawing is a representation; it consists of a cylinder of wood ten inches and three-quarters in diameter, and twenty-four inches long, and divided into eight sections of three inches in each, and fixed upon a spindle of iron about four feet in length, and one inch and a quarter thick. The apparatus was accurately turned and polished. Upon the upper part of the spindle, a small cylinder, or pulley, six inches in diameter was fixed, and a fine flexible silken cord, communicating with the weight, was wound; the apparatus was then fixed in an iron frame, and the frame let into a groove in two upright posts, driven into the bed of the river Thames.

The object of the frame was to allow the cylinder to slide up and down with the level of the tide, and immerse it more or less according to the experiment required to be tried. The friction of the apparatus, or the time that the weight took to descend in the atmosphere was first noticed; after which it was successively immersed in the water three, six, nine, twelve, fifteen, eighteen, twenty-one, and twenty-four inches, the difference of time showing the retardation according to the annexed table.

Experiments on the friction of the surface of a cylinder, twenty-four inches long and ten inches three-quarters diameter, moving in air and in water.

Table I.

On Surfaces in Water.

Depth of immersion of cylinder.	Wt. suspended.	No. of revolutions of cylinder falling the whole height of 26 feet.	Time in descending in water.	Velocity of periphery per secd. in water.	Time in descending in air.	Velocity of periphery per secd. in air.	Difference between air & water.	Remarks.
In.	lb.		scds.	inches.	scds.	inches.	scds.	
3			15.00	36.021			5.00	Resistance in-
6		Sixteen turns	18.00	30.017			8.00	creased by surface
9		in descending.	25.00	21.612			15.00	with slow veloci-
12	1	Periphery	28.00	19.267	10	54.032	18.00	ties, but not in the
15		moves thro'	32.00	16.885			22.00	ratio of the sur-
18		540.32 inches.	37.00	14.603			27.00	faces.
21			40.00	13.508			30.00	
24			55.00	9.824			45.00	
3			9.00	60.035			4.00	
6			10.00	54.032			5.00	
9			10.50	51.459			5.50	Resistance scarce-
12	2	Ditto.	10.50	51.459	5	108.064	5.50	ly influenced by
15			10.50	51.459			5.50	surface with in-
18			10.50	51.459			5.50	creased velocities.
21			11.00	49.120			6.00	
24			11.00	49.120			6.00	
On Velocities in water.								
in.	lb.		scds.	inches.	scds.	inches.	scds.	
24	4		8.0	67.54	2.45	196.48	5.15	
24	8	Ditto.	6.0	90.053	2.00	270.16	4.00	Could not be tried.
24	16		4.0	135.08	1.50	360.21	2.50	
24	32		2.5	216.128				

Conclusions.

1. That the friction or adhesion of water against the surfaces of solids in motion, approximates the ratio of the surfaces with slow velocities; but that an increase of surface does not materially affect it with increased velocities.

2. That with equal surfaces the velocities do not seem to observe any fixed ratio, but approximate to the squares of the resistance.

With increased velocities the index of the power was found to be less than the duplicate ratio.

To exemplify the result of the foregoing conclusions in a different way,—the cylinder was removed, and circular discs of iron, ten inches and three-quarters diameter, and one-eighth of an inch thick, accurately adjusted to the spindle, and polished, were substituted, as Fig. 2. The friction of the apparatus was again tried, and immersed in the river Thames as before.

Table II.

Experiments on the friction in water of circular discs ten inches and three-quarters in diameter and one-eighth of an inch thick, revolving with the planes parallel to the horizon, and six inches apart.

No. of discs.	Wt. suspended.	Height fallen of weight.	Time of wt. descending in water.	Velocity of periphery per second.	Time descending in air.	Velocity of periphery per second in air.	Difference.
	lbs.	Twenty-five	scds.	inches.	scds.	inches.	scds.
	1	feet, mean cir-	10.00	42.200			8.00
	2	cle 16.88	5.00	84.400			3.00
1	3	would move	3.00	140.660	2	211	1.00
	4	through 422	3.00	140.660			1.00
	6	inches.	3.00	140.660			1.00
	1		15.00	28.133			13.00
	2		6.50	64.923			4.50
2	3	Ditto.	4.50	93.770	2	211	2.50
	4		4.00	105.500			2.00
	6		4.00	105.500			200
	1		17.00	24.823			15.00
	2		7.00	60.285			5.00
3.	3	Ditto.	5.50	76.727	2	211	3.50
	4		4.00	105.500			2.00
	6		3.00	140.660			1.0 0
	1		33.00	12.787			31.00
	2		17.00	24.823			15.00
4	3	Ditto.	8.00	52.750	2	211	6.00
	4		6.00	64.923			4.00
	6		4.00	105.500			2.00

Conclusions.

That the friction or adhesion of water is not quite as the surfaces with slow velocities, being in the ratio of one to three instead of one to four, but diminishes rapidly; without observing any ratio in increased velocities.* Hence, the resistance of a ship or vessel moving

* The experiments of the Society for the improvement of Naval Architecture show a decreased resistance with increased velocities.

through the water, with an average or higher rate of velocity, forms an inconsiderable portion of the resistance resulting from the displacement of the fluid, and that the brightness observed on the copper of ships after a voyage, may be owing to other causes than the friction of the water simply.

An experiment was made to ascertain the comparative resistance of a pipe revolving in water, and with water running through a pipe; when the resistance was found to be as the surfaces in slow velocities, but to diminish greatly, as before in high velocities, without observing any fixed ratio.

The above conclusions are in contradiction of those of Coulomb, who did not find that pressure augmented the resistance, but states that the resistance is greater when the immersion is partial.

This apparatus being applicable to fluids generally, advantage was taken of it to ascertain the direct resistance of solids to fluids,* by causing plates and globes to revolve in them, with their planes perpendicular to the plane of the horizon, (see Fig. 3.)

As the resistance of solids in fluids does not form the object of this paper, it will be necessary to introduce many detailed observations on the subject of these experiments at present, connected as they are with another branch of hydrodynamics. But as it is important to show the relation subsisting between the resistances of cohesion and impulse, I have ventured to detail the following experiments.

Table III.

Experiments on the rotations of iron discs and wooden balls moving in air, with their planes perpendicular to the plane of the horizon.

Wt. suspended.	Height fallen.	Time in descending.					
		Two circular discs 10¼ inches diameter. Area 81 in.	Velocity per second.	Two square fans. Area 81 inches.	Velocity per second.	Two wooden balls 10¼ in. diameter.	Velocity per second.
lbs.	The spindle made	scds.	feet.	scds.	feet.	scds.	feet.
2	15.9 turns in falling	10.00	6.867	10.00	6.867	23	2.984
4	25 feet. Mean circle	6.00	11.445	7.00	9.810	13	5.282
9	51.83 would move	4.50	15.261	4.50	15.261	8	8.584
16	through 6 8.67 feet.	3.00	22.891	3.25	21.130	7	9.810
20		2.50	27.469	3.00	22.891	6	11.445

* In this case, the number of particles struck will be diminished in the ratio of the radius to the sine of inclination; wherefore the resistance will be diminished in a duplicate ratio of the radius to the sine of inclination. But as the sines of inclination of the two plates are equal, the resistances will be equivalent to the area of one plate (moving perpendicularly to its plane) into the duplicate ratio of the velocity of its motion, and the density of the fluid.

Conclusions.

1. That the resistances are as the squares of the velocity.
2. That the comparative resistances between discs and globes are as two to one nearly.

Table IV.

Experiments on the resistance of iron discs and wooden globes revolving in water.

Weight.	Height fallen.	Time in descending.					
		Two circular discs 81 inches area.	Velocity per second.	Two square fans, 9 in. square, 81 in. area each.	Velocity per second.	Two wooden balls. Area 81 inches.	Velocity per second.
lbs.	The spindle made	scds.	feet.	scds.	feet.	scds.	feet.
16	15.9 turns in falling	63	1.09	53	1.29	15.00	4.57
20	25 feet. Mean circle	54	1.27	48	1.43	14.00	4.90
32	51.83 would move	43	1.59	40	1.71	10.50	6.59
40	through 824.19 inch-	40	1.71	35	1.96	9.50	7.22
64	es, or 68.67 feet.	30	2.28	28	2.45	8.00	8.58
256		14	4.90	15	4.57	5.00	13.73

Conclusions.

1. That the resistances are the square of the velocity.
2. That the mean resistances of circular discs, square plates, and globes in air, are as the numbers 25.180, 22.010, 10.627; and in water, 1.18, 1.36, 0.755; consequently the proportional resistances of air to water, with

Circular discs, is as	1 to 21.3
Plates and fans,	1 to 16.2
Wooden balls,	1 to 2.2

Note.—A portion of the square fans, represented in Fig. 3, and equal to one-fourth of the area of each fan, was cut off, when the resistance was found to be the same as with the square fans.

Experiments on the quantities of water discharged by orifices and tubes of different diameters and lengths, and at different altitudes.

The phenomena incident to spouting fluids are,

First, The inequality observed in the velocity of the particles comprised in every horizontal section parallel to the orifice.

Secondly, The contraction of the fluid vein beyond the orifice, and consequent diminution of discharge as compared with theory.

Thirdly, The inversion and changes in the sections of the fluid vein at different distances from the orifices.

All these phenomena have been noticed and recorded by various writers, and formulæ adapted to the different circumstances of the

expenditure have been given. But neither Bossut or Du Buat, (the most accurate of writers,) have recorded a continuous and systematic series of experiments upon the comparative expenditure of orifices and tubes under the circumstances of area, altitude, and length.

The apparatus with which these experiments were performed, consisted of a wooden cistern very accurately made, two feet square inside, and four feet four inches in height. The water was kept at a constant altitude by a regulating cock; and a float, having an index attached to it, enabled the observer to ascertain the exact height at which the water stood in the cistern above the centre of the orifice.

The orifices were accurately made by Dollond in brass plates one-sixtieth of an inch in thickness. The plates were accurately adjusted to a hole in the side of the cistern, and closed by a valve of brass ground to each of the plates. The valve was opened by a lever, and the time noted by chronometers.

The diameters of the tubes, from having been drawn on mandrils, were as accurate as possible; their diameters at the extremities were carefully enlarged, to prevent any wire edges from diminishing their sections; and one extremity of the tube being inserted into a block of hard wood fastened to the cistern, and the other stopped by a valve, the experiments were recorded as before.

Circular orifice made in a brass plate 1 in. diameter, $\frac{1}{60}$ in. thick.				
Constant height of the surface of the water above the centre of orifice.	Real time in discharging one cubic foot.	Theoretical time in discharging one cubic foot. $t=\frac{Q}{2A\sqrt{gH}}$.	Ratio of the theoretical to the real discharges.	Vena contracta.
feet.	scds.	seconds.		
4	19.50	11.4	1 ; .584	
3	21	13.2	1 ; .628	Not accurately measured.
2	26	16.1	1 ; .619	
1	36	22.8	1 ; .633	
Circular orifice in a brass plate ¾ in. diameter, $\frac{1}{60}$ in. thick.				
4	33	20.3	1 ; .614	At six-tenths of an inch from the orifice, the diameter had contracted to 0.685 of an inch.
3	37	23.4	1 ; .632	
2	44	28.7	1 ; .652	
1	63	40.6	1 ; .644	
Circular orifice in a brass plate ½ in. diameter, $\frac{1}{60}$ in. thick.				
4	73	45.7	1 ; .626	At half an inch beyond the orifice, the diameter contracted to 0.37 of an inch.
3	83	52.8	1 ; .633	
2	104	64.6	1 ; .621	
1	144	91.4	1 ; .631	
Circular orifice in a brass plate ¼ in. diameter, $\frac{1}{60}$ in thick.				
4	276	182.9	1 ; .662	At ¼ in. beyond the orifice, the diameter contracted to one-twentieth inch less than the orifice.
3	320	211.3	1 ; .660	
2	396	258.6	1 ; .653	
1	545	365.7	1 ; .671	

N. B. Each result shows the mean of four experiments.

Remarks.

The phenomena relative to the form and direction of veins of spouting fluids, and the remarkable inversion of the fluid veins at certain distances from their orifices, have been so fully noticed in "Experiences sur la Forme et sur la Direction des Veins et des Courans d'Eau; par George Bidone; Turin, 1829," that it is unnecessary to state further, than that they have been completely corroborated in the foregoing experiments.

[TO BE CONTINUED.]

On the determination of the thickness of solid Substances, not otherwise measurable, by Magnetic Deviations. By the Rev. William Scoresby, F. R. S.

In the first part of this paper, the author states the results of a series of experiments undertaken by him with the view of ascertaining whether all bodies are equally and uniformly permeable to the magnetic influence. Out of a great number of substances not ferruginous, but of various qualities, thickness, and solidity, which were subjected to trial, no instance occurred of their offering any perceptible obstruction to the action of a magnet on a compass, when interposed between them. No interruption to this action occurred, even when the intervening bodies were iron ores, of which several were tried, excepting in one or two cases in which the ore was found to be itself magnetic. Hence, the author was led to conceive, that an accurate estimation of the magnetic influence transmitted through solid substances, might afford an excellent mode of ascertaining the thickness of such substances which might not be otherwise determinable.

In order to judge of the degree of accuracy with which this might be accomplished, he instituted various sets of experiments; first, placing the magnet in a line pointing to the centre of the compass, and on a level with it, in the east and west magnetic direction; and secondly, in positions more or less oblique to this direction. He found reason to conclude from these trials, that the degree of accuracy attainable by this method was such as to render it highly advantageous in mining operations. Thus the thickness of a mass of freestone rock on the Liverpool and Manchester rail-way, three feet two inches in thickness, was determined by this method to within the eighth of an inch of its actual measurement, exhibiting an error of only one 334th part of the whole.

Many experiments were made to determine the effect which the form, dimensions, quality, and number of magnets have on the extent of their directive influence on the compass. It was found that little, if any augmentation of power results from increasing the thickness of the magnet; but that, with magnets of similar form, the directive forces are nearly in the direct ratio of their lengths. The author gives the results of an extensive series of experiments on the combined influence of several magnets, arranged, either in contact or in juxtaposition, in a great variety of ways. The contact of dissimilar poles

was in all cases productive of an increase, and that of similar poles of a diminution of efficiency.

In the second part of this paper the author enters into an investigation of the law of the magnetic directive power, with reference to distance; in which he finds it convenient to estimate all distances in multiples of the length of the magnet employed, or, more correctly, of the interval between its two poles. From the established law of magnetic force, namely, that it is in the inverse duplicate ratio of the distance, the author deduces formula for estimating the directive power of a magnet on a compass at different distances. The combined action of four magnets, on a compass of Captain Kater's construction, which was five inches in diameter, will afford a tolerably accurate measurement of the thickness of any solid intervening substance, when about forty feet thick; but even at the distance of eighty-two feet the deviation produced by the magnet will be two minutes of a degree, and therefore still very appreciable. But the sensibility of the compass to the magnetic influence might be much further increased, by the application of a small directing magnet, placed in such a situation as to neutralize the greater part of the directive influence of the earth. By this means the author obtained a deviation in the compass of about 5′, at a distance of 61 feet, which extended through a variety of solid materials, including soil, stones, and brickwork.

In the third part of this paper the author treats of the practical application of the magnetical influence in engineering, in tunneling, and in mining, for determining the thickness of solid masses in different situations where circumstances preclude the possibility of direct measurement. He adduces a variety of instances in which the information thus obtained would prove of the greatest value, in directing the operations in progress, or determining those to be undertaken, and frequently in preventing the occurrence of accidents which the want of such knowledge may occasion. He concludes with a statement and explanation of various practical directions for the employment of the method recommended.

[*Trans. Royal Society. Phil. Mag.*

Manufacture of Vinegar from Grain. By Monsieur Dubrunfaut.

The grain employed in this manufacture is a mixture of one part malt with four parts rye; ground in the same manner as for brewing or distillation. Rye is preferred to malt, because it more easily turns acid.

In this state the corn is macerated in about six or eight times its weight of water, as in a distilling process. The soaking, fermentation, &c. is all conducted as in the making of alcohol. In fact, the result of this first stage of the operation is to make a wine.

When the fermentation has subsided, which takes place in the course of a few days, the alcoholized mass is divided into two portions, the liquid from the compact residuum; which latter is placed in a vessel to undergo distillation, the draining of this distillation is added

to the clear liquid, and passes into a heated chamber to undergo the acetous fermentation.

The heated chamber contains barrels placed upon their sides and on tressels. These barrels are half, or three-fourths, filled with liquid. To set the whole in action one-fourth or one-fifth of their capacity is supplied by vinegar prepared in the ordinary manner, together with the membraneous substance which is formed in the barrels where the vinegar is preserved. This being done, the barrels are filled to the half, or two-thirds, with the above mentioned clear decoction.

The room in which the vessels are placed should be kept at a constant temperature of from 30° to 35° of Réaumur. Every day the liquid is drawn off from each vessel, and poured upon the others. To accomplish this an empty cask is used to receive the contents of the first barrel; this receives the contents of the second, and so on in succession. This operation, by agitating and airing the liquid, favours the production of the vinegar, and it should be repeated many times a day.

By the above process the vinegar is fully developed at the end of a month or six weeks. If the whole operation have been well conducted, the half of the vinegar contained in each vessel is drawn off into small casks, placed in a cool chamber, where the clarifying is performed.

The space produced in each cask by this reduction, is filled by the alcoholized liquid, equal to the volume of vinegar that has been drawn off.

The clarification is effected with beech shavings, which possess an astringent quality. [*Agricult. Manufacturier.*

On the Thermostat or Heat Governor, a self-acting physical apparatus for regulating Temperature. Constructed by Andrew Ure, M. D. F. R. S.

The principle of the instrument here described is the unequal expansion of different metals by heat. A bar of zinc, alloyed with four or five per cent. of copper, and one of tin, about an inch in breadth, one quarter of an inch thick, and two feet long, is firmly and closely riveted along its face to the face of a similar bar of steel about one-third in thickness. The product of the rigidity and strength should be nearly the same, so that the texture of each may pretty equally resist the strains of flexure. Twelve such compound bars are united in pairs by a hinge joint at each of their ends; having the zinc or alloy bars fronting one another. At ordinary temperatures these bars will be parallel, and nearly in contact; but when heated, they bend outwards, receding from each other at their middle parts, like two bows tied together at their ends. When a more considerable expansion is wanted, a series of such bars is laid one over the other. The movement thus resulting is applied by the author in various ways to regulate the opening of dampers, letting in either cold air or cold water,

or closing the draught of a fire-place, as the case may be. He proposes its employment to regulate the safety valves of steam boilers, as working with more certainty than the common expedients.

[*Trans. Royal Society. Phil. Mag.*

Note by the Editor.—The foregoing appears to be identical with the method of regulating heat for which L. W. Wright obtained a patent in August last. This similarity was referred to in noticing that patent. See pages 130, 131.

Poisoning by the (Sebacic) Acid of Goose Grease.

On the 2nd of April, 1829, Dr. Seidler was called to attend MM. H——, and their children. On his arrival he found the two brothers H——, one aged thirty-one, the second twenty-eight years, and the two children of the first, one a girl æt. four, the other a boy æt. two and a half, all presenting the following symptoms,—cold sweat, anxiety, vertigo, general paleness, and prostration of strength, eyes sunken and pupils dilated; burning pain was felt in the lower part of the belly, increased by pressure; violent vomiting, succeeded by ardent thirst, for which the patients had drunk large quantities of milk, which was thrown up without producing any effect; tongue dry; involuntary discharge of urine and fæces.

The eldest brother was insensible for six minutes; his respiration was scarcely visible, his pulse imperceptible, and the heart's action exceedingly weak. The second brother had vomited blood several times, but he experienced less abdominal pain than the other. In the little boy the globes of the eyes were turned upwards, the lips livid, and the pulse scarcely sensible. Lastly, the symptoms in the little girl were the mildest of all. M. Seidler suspected at once that these accidents were occasioned by the use of a certain quantity of goose grease, which had been employed in the preparation of some meat, of which the four patients had eaten shortly before the symptoms began. An emulsion, containing hyoscyamus, was prescribed, and on the 9th of April all had recovered.

The vomited matters were subjected to chemical analysis: they were strongly acid, but contained no metallic poison: but the following facts induced Dr. Seidler to attribute the illness to the effect of sebacic acid. The lady of the house had made use of goose grease to dress some veal, and all the persons who partook of the dish fell quickly sick. The lady herself, who had barely tasted it, felt it so disagreeable that she took no more. None of the grease which was suspected to have caused the accident, remained for examination, the pot which contained it having been entirely emptied and cleaned out; but on examining the same kind of grease contained in three other pots, it was found to exhale a strong repulsive odour, and it reddened strongly blue paper tinged by turnsole. Three ounces of this grease were given to a vigorous, well-formed dog: an hour after his extremities became violently convulsed; he cried piteously, he refused to eat, his eyes were suffused, pupils dilated, skin cold, and arterial

pulsation scarcely perceptible. In this state he continued for thirty hours, after which he slowly recovered. [*Hufeland's Journal.*

Method of Marking Linen.

The necessity of marking the linen of hospitals, &c. in a perfect and durable manner, so as to resist the action of alkalies, soap, &c. is so important as to have induced M. Henry to examine the methods in use, and endeavour to replace them by a better. The sulphate and muriate of manganese, the sulphate and acetate of iron, nitrate of silver, acetate of alumine and iron, and acetate of lead, mixed with gum or indigo, or ink, have been used for the purpose; but all either require previous or subsequent operations of some nicety, as immersion in carbonated alkalies or hydro-sulphurets, or else such degree of care as to be inexpedient in the hands of the women or persons to whom the duty generally devolves.

The following is the process which M. Henry ultimately recommends as the very best. Take one part, by weight, of iron filings, and three parts of vinegar, or acetic acid of s. g. 1056. Mix the filings with half the vinegar, and agitate it continually. As it thickens, add the rest of the vinegar, and also one part of water. Then apply heat to assist the action, and when all the iron is dissolved, add three parts of sulphate of iron, and one part of gum arabic previously dissolved in four parts of water. These are to be mixed well at a gentle heat, and will yield twelve parts of the preparation.

When to be used, the linen is to be spread on a table, and the preparation applied by means of a hair brush, and stencil plates of copper.—*Jour. de Pharm.* 1831, *p.* 388.

New applications of Artificial Ultramarine.

It is well known that a few years since M. Guimet discovered a process of manufacturing ultramarine from its proximate elements, and without the use of lapis lazuli. He has latterly described a great extension of this, his manufacture, in a letter to M. Gay Lussac. A paper manufacturer wished to apply this ultramarine in place of smalt to the colouration of his papers, and was, in consequence, supplied with a sufficient quantity to make a large experiment. The latter paper made had as good a tint as that coloured with smalt, and was more uniform, but it was found that, in producing this effect, the one pound of ultramarine, because of its extreme division and intense colour, was as effectual as ten pounds of the finest smalts. After this, 200 lbs. of ultramarine were sold to the paper makers of Lyons at the price of twenty francs, per pound, and proved to be more economical than smalt. In consequence, M. Guimet has very much extended his manufactory, and is able to sell ultramarine for these uses at the price of sixteen francs per pound.

The ultramarine for painters requires a particular purification, as well as careful selection from all that is manufactured. The price

for the finest quality is sixty francs the pound. The second quality is twenty francs the pound.

Besides its use in paper making, the manufacturers of calicoes, muslins, &c. &c. are beginning to use it, and M. Guimet expresses a hope, that shortly France will be entirely independent of other countries for the blues required for these uses.

[*Ann. de Chimie*, xlvi. 431.

A machine for drilling Cast Iron, used in the manufactory of Monsieur Calla.

This machine which acts upon the principle of the stock and bit, is simple and solid, being composed entirely of iron. It works with as much regularity as promptitude.

The block to be perforated, being firmly fixed upon a solid plank, the drill is brought down upon it. The operation consists in turning a fly, which plays upon a roller, a cord from which is fastened to the lever which brings down the drill. The moving power being acted upon, the tool turns with considerable rapidity; but as the weight of the apparatus would not be of itself sufficient to urge it forward in proportion to the progress of the drill, the fly is kept constantly turning.

When the hole is perforated the tool is withdrawn by raising the apparatus, which preserves its vertical position, whatever may be the degree of elevation or depression of the lever to which it is suspended.

[*Rep. Pat. Inv.*

Resistance opposed to Water moving in Pipes.

Notwithstanding the endeavours made to deduce formula from experiments on the passage of water through tubes, so as to assist and guide the engineer in laying down pipes to supply manufactories or towns, yet frequent mistakes have occurred: thus at Paris, at the *Fountaine des Innocens*, only two-thirds of the water calculated upon were obtained; whilst in the *faubourg St. Victor*, only the half of that expected issued from the pipes. These differences appear to result from experiments made on too small a scale, or with apertures disproportionate to the areas of the tubes; for the results of practice come sufficiently near to the formula of MM. Prony and Eytelwein, when the velocity of motion in a pipe was small in consequence of a contracted aperture made in a plate of metal being used. When the contracting plate was altogether removed, then the product in water was a fourth or third less than that given by the formula; from which M. D'Aubuisson concludes that the resistance increases with the velocity in a greater ratio than that given to it in the calculations; where it is supposed to increase proportionally $a\ v^2 + m\ v$, m being nearly equal to 0.055, and v representing the mean velocity.

In consequence of the arrangement and state of the water pipes at Toulouse, some large and accurate experiments have been made

there by MM. Castel and D'Aubuisson, the systems of pipes of 4.7 inches and 10.63 inches in diameter, and 1434 and 1986 feet in length. In these experiments the quantity of water passed and the pressure were varied; the results were noted and also calculated by the formula, so as to deduce the loss of pressure due to the resistance of the pipes; that, by calculation, came out 27., 25., 32.7, and 31.7 per cent. below the result of experiment. As the two latter were the principal experiments, it is concluded that, generally, calculation gives the resistance nearly one-third less than what is obtained by actual and careful practice.—*Ann. de Chimie.*

Machine for Cutting Veneering Wood into thin sheets, and of every length.

This machine, employed in Russia, possesses this peculiarity; that instead of cutting the wood from the flat and thick surface, it carries off from its circumference a continuous shaving; the result of which is, that leaves of an indefinite length are produced, agreeably veined and knotted.

The construction is simple, combining the advantage of cutting the precious woods without waste, and very rapidly, to an extraornary extent, and so thin that they have been employed for the covering of books, and for lithographic and other engraving. One hundred feet in length of veneering may be cut in the space of three minutes.

They begin by placing the timber from which the leaf is to be cut, upon a square axle; when it is revolved and made circular with a turner's gouge. The blade of a plane of highly tempered steel, and rather longer than the cylinder, is fixed at the extremity of a frame six or seven feet in length, in such a manner as to exert a constant pressure upon the cylinder, and pare off a sheet of an equal thickness, which folds upon another cylinder like a roll of linen. The frame to which the blade is attached, is moveable at its lower extremity, and as it is charged, it depresses in proportion as the mass diminishes in substance. That this depression may be progressive and perfectly regular, the inventor has appended a regulator to the machine, consisting of a flat brass plate, preserved in an inclined position, upon which the frame descends as the regulator itself is advanced. The motion is communicated to the cylinder by means of several cog wheels, which are turned by a crank. [*Ib.*

Improvement in the mode of making Paper for Writing, Printing, and Wrapping from Wood.

The wood is reduced to shavings of the ordinary jack-plane shaving size, so as to be rendered nearly of the same size: these are then placed in a cistern or boiler, sufficiently large, and covered with water which is raised to the boiling point of heat. To every one

hundred pounds of the wood so reduced, from twelve to eighteen pounds of alkali, either vegetable or mineral, are put, in proportion to its quality for strength. If salts are used, they should be reduced before they are placed on the wood. They may, however, be put in with the water and wood before reduction, but the first method is the most preferable. Should lime be used, there must be a sufficient quantity in all cases to equal twelve pounds of pure black salts. One hundred pounds of wood will, if well attended to, make from five to seven reams of paper. [*New Monthly Mag.*

Meteorological Observations for March, 1832.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches.				Inches.	
⊗	1	26°	49°	30.30	30 30	17	NE. SW.	Moderate.		Clear day.
	2	32	51	.30	.94	34	E. E.	do.		Cloudy—clear.
	3	41	58	29.84	29.84	32	SW. W.	Blustering.		Flying clouds—clear.
	4	28	53	30.00	.95	30	W. SW.	Moderate.		Clear—overcast.
	5	45	52	29.60	.50	48	SE. W.	do.	.44	Rain—cloudy.
	6	36	50	.50	.50	24	W. W.	Blustering.		Flying clouds—cloudy.
	7	31	48	.80	.80	25	W.	do.		Clear day.
	8	28	55	30.10	30.10	30	W. SW.	Moderate.		Clear day.
☽	9	35	60	.10	.00	37	SW. S.	do.		Clear—hazy.
	10	35	63	.00	.10	45	SW.	do.		Fog—cloudy.
	11	39	58	.10	.00	58	S. SE.	do.		Showers—cloudy.
	12	63	67	29.80	29.60	62	SW.	do.	.65	Rain—cloudy—thund. sh.
	13	44	56	.50	.60	44	W.	do.	.15	Clear day—snow and rain
☉	14	18	96	.70	.80	9	W.	Blustering	.4	Cloudy—flying clouds.
	15	18	36	30.20	30.20	10	N. W.	Moderate.		Clear day.
	16	26	50	.20	.20	26	S. SW.	do.		Clear day.
	17	41	42	29.70	29.50	30	NE. W.	Blustering.	.48	Rain—snow and rain.
	18	11	24	.70	.80	1	W.	do.		Cloudy day.
	19	17	31	30.15	30.15	4	W.	Moderate.		Clear day.
	20	31	47	.10	29.95	31	SW. S.	do.		Cloudy day.
	21	40	44	29.55	.55	26	W.	Blustering.		Cloudy—flying clouds.
	22	28	38	.70	.80	12	W.	do.		Clear day.
☾	23	26	54	30.00	.94	26	E. S.	do.		Hazy—clear.
	24	44	68	29.90	.90	41	SW.	Moderate.		Cloudy—hazy.
	25	44	73	.90	.80	50	SW. S.	Blustering.		Fog—clear.
	26	46	44	.70	.70	45	SW.	do.	.42	Rain—clear.
	27	36	42	30.20	30.20	20	NW. W.	Moderate.		Clear day.
	28	31	54	.20	.20	27	W. SW.	do.		Cloudy—clear.
	29	34	55	.10	.10	32	W. SW.	do.		Clear day.
	30	39	54	.20	.20	34	SE.	do.		Cloudy—clear.
	31	36	64	.5	29.80	46	SW.	Blustering.		Cloudy—clear.
	Mean	33.84	50.29	29.94	29.91	34.6			2.18	

		Thermometer.	Barometer.
Maximum height during the month,		73. on 25th.	30.30 on 1st.
Minimum	do.	11. on 18th.	29.50 on 5th, 6th, 13th and 17th.
Mean	do.	42.07	29.92

JOURNAL

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FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

MAY, 1832.

Further remarks on the application of water upon wheels, with reference to a communication under the signature of C. in the last number. By JAMES P. ESPY.

TO THE COMMITTEE OF PUBLICATION OF THE FRANKLIN INSTITUTE.

GENTLEMEN,—In the preceding number of this Journal, I find an article signed C., containing, among other things, the following statement. "Mr. Espy arrives at (what I conceive to be) the erroneous conclusion that water let on to a wheel at a less velocity than that of the wheel itself, will give a maximum effect."

I am much obliged to C. for turning my attention to this subject again, particularly as I now believe with C. that my conclusion on this point was an erroneous one.

The question under discussion is, what power is lost at the Fair Mount water works by letting the water on the wheel under a one foot head at an angle of forty-five degrees with the tangent, the wheel moving with a velocity of twelve feet per second?

In the paper which C. criticises I had endeavoured to show that more power was gained by letting the water on the wheel above the point where it would have the velocity of the wheel, than was lost by the retarding effect of inertia, in being suddenly accelerated by the wheel itself.

The calculation was made on the supposition that water, or any other heavy body, produces the same mechanical effect by moving with a uniform velocity downwards the same distance, whatever its velocity may be.

If this supposition is correct, (and perhaps some may still think it is,) my former calculation was right. Perhaps the question can be settled to every body's satisfaction only by experiment. I believe, however, upon mature deliberation, that *time* is the element in this calculation, and not *space*.

For example, the water at Fair Mount comes on the wheel with a velocity six and one half feet slower than the motion of the wheel. Now, if time is the element to be considered, it must lie on the wheel, to balance inertia, as long as a body takes to acquire the velocity of six and a half feet in falling freely through space from the commencement of its motion.

This time is about one-fifth of a second, therefore the water must lie on the wheel one-fifth of a second in order to balance the inertia; but as the wheel moves with a velocity of twelve feet per second, the space will be one-fifth of twelve feet, or nearly twenty-nine inches.

According to this mode of calculation, therefore, the loss of power due to inertia alone is twenty-nine inches, and if to this twelve inches be added, because the water comes on the wheel twelve inches below the surface of the dam, the whole loss of power will be forty-one inches. Whether this mode of calculation will meet the views of C. I do not know, for he does not say definitely what the loss of power is, he only says, it is "more than twenty-seven inches."

From these remarks, C. will perceive that, as he imagined, I have "at once seen the error into which I had inadvertently fallen, and as promptly corrected it."

I cannot, however, agree with C. "that L. M. has erred in supposing that water in motion at a velocity due to one foot head, viz. eight feet per second, at an angle of forty-five degrees to the direction of the wheel, would oppose a resistance to the buckets by the influence of its inertia, proportioned to the difference between the velocity of the wheel and that of the water in the direction of the wheel, viz. six and a half feet." Nor do I think that the "error is obvious from the fact, that the water strikes the soaling of the wheel at an angle of forty-five degrees, by which its motion, instead of being destroyed, is only changed to the direction of the wheel's motion, and that therefore, all which can be lost by this change of direction, is what may be occasioned by the agitation of the water, and, therefore, it moves in the direction of the wheel at a velocity but little less than eight feet per second." For, in the first place, we have no reason for supposing that the water moves faster in the direction of the wheel after it strikes the soaling than before; and, in the second place, we are sure, "from first principles," if it does move faster it is only by reacting on the wheel.

For action and reaction are equal, and in opposite directions. Therefore, if the water spends its force on the soaling of the wheel in changing its direction, if that soaling is parallel to the tangent, its velocity in the direction of the tangent can neither be increased nor diminished.

If we suppose the water and the soaling both perfectly elastic; the water upon striking the soaling would rebound, making the angle of reflection equal to the angle of incidence; and the velocity in the

direction of the tangent, would evidently remain the same. If we suppose the water and the soaling both perfectly hard and smooth, upon striking the soaling, the motion of the water in the direction of the radius of the wheel would be entirely destroyed, whilst that in the direction of the tangent would remain the same.

I think it is not necessary to pursue this subject further, especially as I am sure C. will have the candour to acknowledge his mistake provided he should be led to discover it by these remarks.

As to the other point in controversy, perhaps some may think that I have given it up too readily, and may still be inclined to believe that my first method of calculating was founded on true principles, and that it is a universal rule, without an exception, that the mechanical effect of water is to be measured by the distance it descends, and in no instance by the time. I will only observe that the point can be settled to the satisfaction of all by the following simple experiment.

Let the water be admitted to a water wheel at various points from the bottom to as near the surface of the water as possible; if *time* is the true element in the calculation in question, the wheel will move with the greatest velocity when the water is introduced at the bottom of the wheel; and it will move slower and slower as it is introduced higher up; but if the space descended is the true element, the velocity of the wheel will be greatest when the water is introduced under one fourth of the whole head, that is, one fourth being above and three fourths below the point of introduction. As the place of introduction varies from this point, the wheel will move slower, until finally the motion will be slowest of all when it is introduced at the bottom of the wheel, or at the surface of the water, at which points the velocities will be equal.

Perhaps I may be permitted, without being considered as departing altogether from the subject of this communication, to introduce again to the notice of C. an experiment which I mentioned in a former controversy with him,* as proving positively that momentum is proportional to the velocity of a body, and not proportional to the square of the velocity, as he contended.

The experiment is this—Let two non-elastic bodies, of different masses, meet each other in opposite directions, with velocities inversely proportional to their masses, the momentum of each will be destroyed, for after the stroke there will be no motion.

To this I will add another: Let two holes of equal areas be made in a vessel containing water, one four feet and the other sixteen feet below the surface of the water in the vessel; it is known that the velocity of the water issuing from the lower hole will be double that of the other, and the quantity of water double in a given time. It is also known, by experiment, that the pressures which these two streams make by impulse against solid planes brought up near the openings, are as four to one. Now the quantity of matter being double, if the momentum is as the square of the velocity, the pressure should be as eight to one.

* See Journal of Franklin Institute, vol. iv. p. 213.

By referring to the article mentioned above, the reader will find that there is a distinction to be made between momentum, or force, and mechanical power, and that it is only the latter which follows the law of the squares of the velocities.

Very respectfully, yours,

J. P. Espy.

Notes of an Observer.—*On the aberration of Light as a means of testing the Cartesian and Newtonian theories of Light.*

In this country, and also in England, the Newtonian theory of light has been almost universally received, both as to colours and to the nature of light, as consisting of material particles projected from luminous bodies. It has, however, been lately shown by Dr. Brewster that the prismatic spectrum is capable of being further analyzed, and that there are but three colours, red, yellow, and blue, and that the intermediate colours are formed by the overlapping of the two contiguous ones.

This analysis was made not by the prism alone, but by letting each of the prismatic colours fall on coloured glass, and he found that when orange, for example, fell on a coloured glass which would absorb red and transmit yellow, the orange was analyzed, for nothing but yellow was transmitted; and when a different coloured glass was used, the red was transmitted, and the yellow absorbed; thus showing that the prismatic orange consists of two kinds of rays of the same refrangibility, but of different colours; and so of green and violet.

It appears also, from the following experiment, that the rays of the same colour, are of different refrangibility.

Let the solar light, after it is separated by the prism, fall upon a thin piece of smalt-blue glass, of proper thickness, and "the red light will be separated into two well defined portions, parted from one another by a broad and perfectly black band, and wholly undistinguishable in colour. Of these, the lowest, or least refrangible, corresponds to the extreme red of the spectrum, and is a perfectly homogeneous light; the other is nearly homogeneous, and without the slightest shade of orange. The orange is altogether obliterated, the next colour being a well defined band of pure and full yellow, which is separated from the second red by a small well defined black line, and from the green by a dark interval." See Lloyd on Light and Vision.

These experiments leave no room to doubt that there are only three primary colours; but as to the nature of light, whether it is caused by radiation or undulation, though the latter theory is evidently gaining ground, it is not yet decided, no decisive experiment having been discovered to settle the matter.

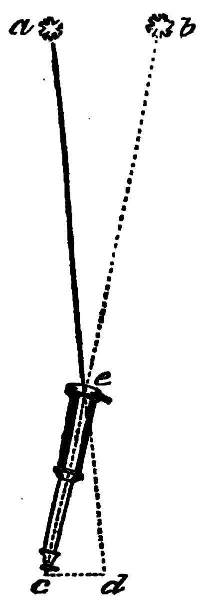
It is acknowledged that, if the Newtonian theory is correct, light moves with greater velocity upon entering a denser medium, from a rarer; but according to the undulatory theory it moves slower upon entering a denser medium.

This being the fact, I propose the following as an experimentum crucis to decide the question.

Let two telescopes be directed to some star near the pole, which passes the meridian above the pole near midnight, and be firmly fixed in such position that a transit will take place at the same instant over a particular division of the micrometers in each of the telescopes. Let the instruments remain in this position for several successive nights, so as to be sure the transit takes place in both at the same instant; then let one of the telescopes be filled with some transparent fluid, as water, having previously made the arrangement to effect this, and also to accommodate the focal distance without changing the position of the instrument. Let a transit of the same star be now observed; if the light moves faster in the water than in the air, the transit will take place sooner in the water telescope than in the air one; but if the light moves slower in the water than in the air, the effect will be the reverse.

If, for example, the light moves only with half the velocity in water that it does in air, the difference in space of the transits in the two instruments will be twenty seconds of a great circle, and if a star be chosen near the north pole, it may amount to many seconds of time.

My view may be explained by the following figure.



Let *a d* be a ray of light passing from a star, *a*, and falling on the object glass of a telescope at *e*. It is known from the aberration of light that if the telescope, from the motion of the earth in her orbit, moves from *c* to *d*, while a ray of light moves from *e* to *d*, that the star *a* will appear in the direction *c b*, and be twenty seconds of space from its true position. If now, as the Newtonian theory requires, a ray of light, upon entering a telescope filled with water, or sulphuret of carbon, should move faster than it does in air, then the telescope could not move from *c* to *d*, while the ray of light is moving from *e* to *d*, and, of course, the star would not appear to be twenty seconds from its true place, and would be seen in some place between *a* and *b*—nearer to *a* as its velocity is greater, and finally at *a*, if the velocity is infinite. If, on the contrary, as the Cartesian hypothesis requires, the ray of light begins to move slower upon entering the fluid telescope, then will the telescope be carried by the motion of the earth farther than from *c* to *d*, while the ray of light is moving from *e* to *d*, and of course the star will appear more than twenty seconds from its true place.

If those who have the means of making this experiment should

avail themselves of it, and communicate the result to the public; it would gratify at least the writer of this article.

Ever Pointed Pencils.

We should be at a loss to name an article which in so short a space of time had so completely won the favour of the public, and put out of use one which was possessed by almost every person, and worn in almost every pocket, as has the ever pointed pencil. What may next be done in this age of rapid improvement, we may probably learn to-morrow; we think, however, that it will not appertain to an instrument of this kind, excepting it may be in its embellishments, as in point of utility it seems well to deserve the motto of *ne plus ultra.*

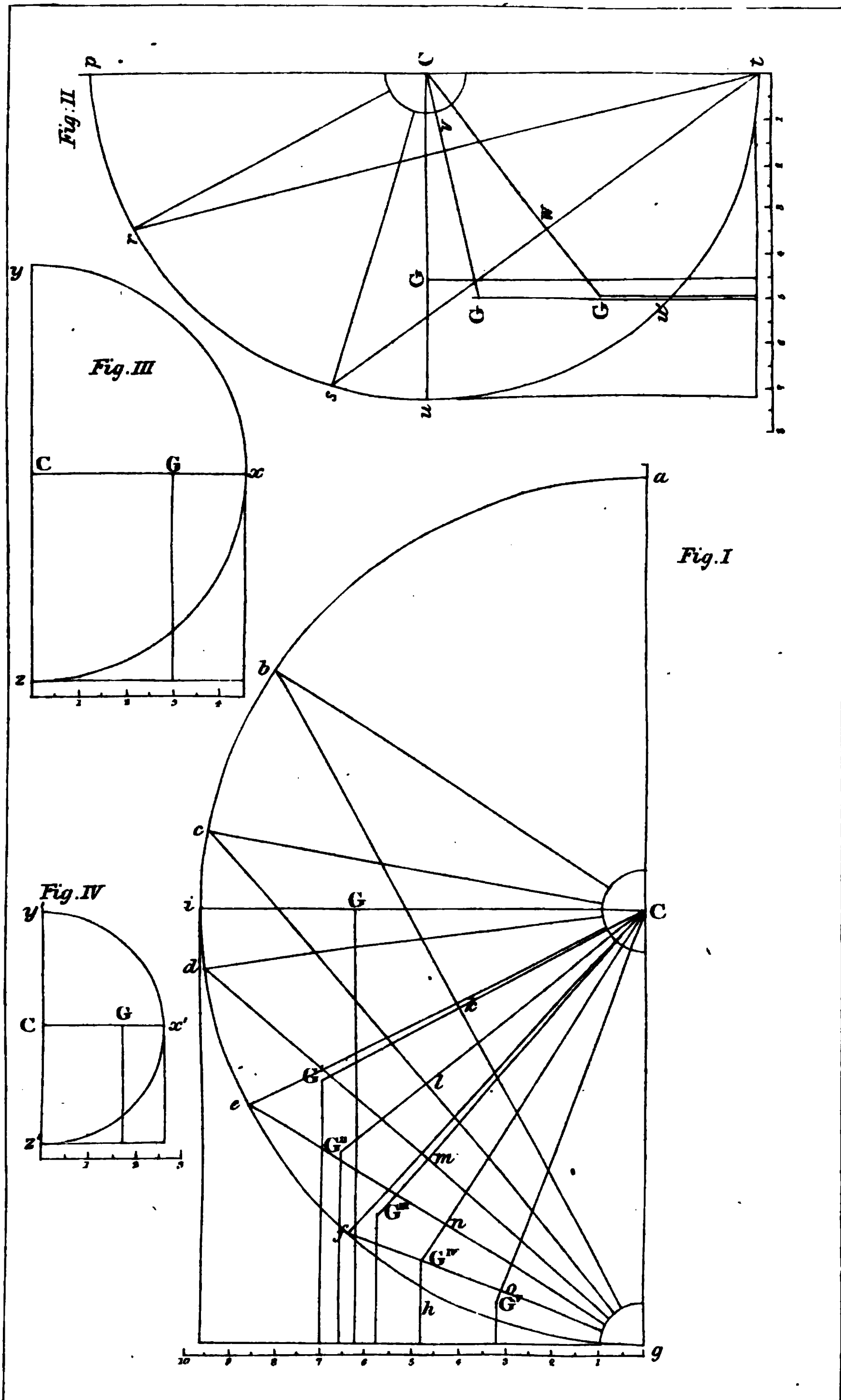
It ought to be universally known that the inventor of this ingenious instrument, was not himself the patentee. We are indebted for it to Mr. John J. Hawkins, civil engineer, a citizen of the United States, although a native of England, and now a resident there. Mr. Hawkins lived for several years in Philadelphia, but returned to England some five and twenty years ago, with the intention, however, of soon returning to the United States, an intention which he has always cherished, and in writing to his friends here, he has uniformly expressed the hope of soon returning *home.*

Mr. Hawkins might readily supply a new version of "A Century of inventions" made by himself; many of them manifesting talents of a very high order, but in most instances not calculated to increase his fortune in this age of utility; and in those which might have done so, as in the case of the ever pointed pencil, which he sold to Mr. Mordan for a small sum, the fruits of his genius have been reaped by others.

At one period Mr. Hawkins was the proprietor of a very interesting museum in London, consisting almost entirely of his own mechanical contrivances. It served as a striking proof of the fertility and versatility of his genius, but as its merits could not be appreciated by "the million," it brought him no other reward. We have now, among our papers, a catalogue of this exhibition, and may hereafter particularly notice some of its contents. The Physiognotrace, by which so many thousand profiles have been taken, first at Peale's museum in Philadelphia, and subsequently in numerous other places, was invented by him, as also was another ingenious instrument, the Manifold Letter Writer, operating likewise upon the principle of the pentagraph, by which two or three pens were made to act by the direction of one.

We have been led to the recording of the preceding remarks and memoranda, from having recently obtained a very beautifully finished ever pointed pencil from the manufactory of Mr. Wm. H. Hale, of Brooklyn, New York. Although the manufacture has become one of great extent in this country, it is but recently that the productions of our workshops have been able to vie with those of England in point of high finish and embellishment, but such is now the case, and the one to which we have just alluded, is the most elegant

Plate V.



and tasteful that we have seen. We had recently noticed in the shops some which were ornamented in the same style, but whether or not by the same hand, we cannot tell; if they were, they exhibit the imperfection usually attendant on earlier efforts, whilst that before us manifests the effect of accurately made machinery, directed by the hands of skill and taste. The ornamenting of the stem is of the kind very properly denominated *damask;* the pattern is produced by a ground formed by the ruling of fine lines upon a polished surface, leaving a brilliant wreath of flowers and foliage, which has the appearance of being raised above the ground. The point through which the lead passes, we observe, is of steel; an improvement that renders permanent the part which was most liable to fail. If we have any objection to this pencil it is its great beauty, which we are unwilling to mar by forcing it into the company of penknives and cents.

EDITOR.

FRANKLIN INSTITUTE.

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, *to ascertain, by experiment, the value of Water as a Moving Power.*

(Continued from p. 157.)

WHEEL NO. II.

THE foregoing tables contain the results of the different experiments made with wheel No. I. These being finished, that wheel was removed and No. II. (fifteen feet in diameter,) substituted for it, upon the same axis. The breast was altered to adapt it to the curvature of the wheel, and the requisite change made in the tail race.

The proportion of friction in wheel No. II. to the weight, was ascertained by the method already described as having been applied in the case of No. I. This gave one per cent. for the ratio in the wheel as well as in the drum above. The reduction in the ratio of friction having taken place in both the wheel and drum, seems to point to the increased smoothness of the gudgeons, and their supports, as the cause of the diminution.

We proceed to calculate the amount of friction for the different weights applied in the experiments. The plan pursued will be that adopted in determining the friction of wheel No. I.

First. Constant *inactive* weight borne by the gudgeons of the wheel and drum during the experiments.

Weight of the wheel, - -	1900 lbs.	
Weight of that part of the chain which was between the barrel of the shaft and the drum,	264 ,,	
Weight of the drum, - -	200 ,,	
Total constant *inactive* weight, -	2364 lbs.	
Friction upon this at one per cent, -		23.64 lbs.

Second. Constant weight *resisting* the mo-

tion of the wheel, and which was borne by the gudgeons of the wheel and drum.		
That part of the chain which was between the barrel of the shaft of the wheel and the ground, - - -	20 lbs.	
The iron basket used to contain the weight,	126 ,,	
Three bars of lead weighing together	111 ,,	
Total constant *resisting* weight, -	257 lbs.	
Friction due to this weight at one per cent.		2.57 lbs.
Total friction from *constant weight*,		26.21 lbs.
The centre of gravity of the water in the buckets of the wheel, when supplied by chute No. 3, (Fig. II. Plate V.) was 5.00 feet from the axis of the wheel, and the barrel about which the chain was wound was one foot from the same axis; hence, to raise 257 lbs. the constant resisting weight, and overcome a friction of 26.21 lbs. the constant friction just found, required a weight of water of	56.64 lbs.	
Friction due to this at one per cent.		.57 lb.
Whole amount of friction when 257 lbs. was raised, - - -		26.78 lbs.
To find the additional friction due to each of the bars of lead which were used as weights, we have,		
Weight of the lead, - -	103.00 lbs.	
To balance this weight and the friction due to it, (103 lbs.+1.03 lb.) or 104.03 lbs., required, at 5 feet from the axis, a weight of water of - - -	29.81 ,,	
Total, - -	123.81 lbs.	
Friction for each bar of lead, -		1.24 lb.

An examination of the amount of friction at the several chutes in wheel No. I. showed such slight variations for the friction due to each lead, that it was not considered necessary to apply calculation to each of the chutes by which water was admitted to wheel No. II., the friction was taken as just determined for all the experiments with this wheel. The distances of the centre of gravity of the loaded part of the wheel when water was admitted through the different chutes, were for chute No. 1, 4.61 feet, for No. 2, 5.1, No. 3, 5.0, No. 4, 4.2.

When eight leads were added to the constant weight in the basket the end *o* (Plate III. vol. vii.) of the shaft was suspended. By a calculation exactly similar to that given in page 79, vol. viii. the friction for each lead, after the eighth, was found to be 2.95 lbs.

We proceed to the details in relation to wheel No. II.

This wheel was fifteen feet in diameter, twenty inches in breadth, and sixteen inches in the clear between the cants, which were six inches deep.

The buckets used were of the elbow form, the depth fourteen inches, the width of elbow three inches, and opening at the throat two and three-fourths inches. The number of buckets was fifty.

It was not considered necessary to furnish these buckets with air vents, the results of experiments upon wheel No. I. having been, in the upper gates, decidedly unfavourable to their use.

The water was applied to this wheel at four different points. No. 1, was an overshot aperture. The height of the point at which the water from No. 2 was delivered, was 14.25 feet above the bottom of the wheel. The corresponding height for chute No. 3 was 10.46. For No. 4, 6.96 feet. The chutes were of the form and dimensions of those applied to wheel No. I. The forms of the gates were those used in the corresponding apertures in wheel No. I, chute No. 1, having a gate of the form *c*, Fig. 3, Plate IV. vol. viii.

The order of the experiments was similar to that described in the case of wheel No. I. The water was admitted through one chute, and with a given aperture and head, and the weight raised was varied until the maximum effect had been passed. The opening was next changed, and a similar series of experiments made. Finally the head was changed.

The experiments made upon one point of admission of the water to the wheel, will form the subject of one table. The tables will be distinguished by the small Roman letters, and, when divided, the parts will be designated by the common (Arabic) numerals. The columns, unless in particular cases to be noted, will correspond to those used in the foregoing tables.

It will be observed that the height through which the weight was raised in these experiments, was made exactly forty feet.

The general series of experiments made with this wheel will be followed by a set having for their object to determine the relative openings required, and quantities of water expended in performing a given amount of work in a given time, when the water was applied at different points of the wheel, and with different heads above the gates.

The details in relation to the series just referred to will precede the table of results.

TABLE a.—PART I.

WHEEL No. II.—CHUTE No. 1.—*Elbow buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	5.50	5.75	6.35	1.00	463	29.26	492.26	40.0	19	14.90	1640	20.5	336200	196904	.585			
2					669	31.74	700.74		23	12.30	1935		396675	280296	.706			
3					772	32.98	804.98		25	11.32	2150		440750	321992	.730			
4					875	34.23	909.22		28	10.12	2400		492000	363688	.739			
5					978	35.46	1013.46		32	8.85	2680		549400	405384	.738			
6					1081	36.70	1117.70		34	8.33	2925		599625	447080	.745			
7					1184	39.66	1223.66		38	7.45	3200		656000	489464	.746	.746	7.45	
8					1287	42.61	1329.61		41	6.90	3515		720575	531844	.738			
9					1390	45.56	1435.56		46	6.15	3800		779000	574224	.737			
10					1493	48.51	1541.51		49	5.78	4125		845625	616604	.729			
11					1596	51.46	1647.46		53	5.34	4475		917375	658984	.718			
12	3.00	3.25	3.85	1.00	978	35.46	1013.46	40.0	46	6.15	2815	18.0	506700	405384	.800			
13					1081	36.70	1117.70		51	5.55	3100		558000	447080	.801	.801	5.55	
14					1184	39.66	1223.66		57	4.98	3460		622800	489464	.786			
15					1287	42.61	1329.61		62	4.57	3865		695700	531844	.764			
16	3.00	3.25	3.85	1.50	1287	42.61	1329.61	40.0	41	6.90	3665	18.0	659700	531844	.806			
17					1390	45.56	1435.56		44	6.44	3900		702000	574224	.818	.818	6.44	
18					1493	48.51	1541.51		48	5.90	4240		763200	616604	.808			
19					1596	51.46	1647.46		52	5.44	4590		826200	658984	.797			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE a.—PART II.

WHEEL No. II—CHUTE No. 1.—*Elbow Buckets. Close Breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
20	1.50	2.35	1.75	1.50	875	34.22	909.22	40.0	46	6.15	2630	16.50	433950	363688	.838			
21					978	35.46	1013.46		52	5.44	2925		482625	405384	.840	.840	5.44	
22					1081	36.70	1117.70		58	4.90	3250		536250	447080	.834			
23	1.50	2.35	1.75	1.75	1081	36.70	1117.70	40.0	50	5.66	3220	16.50	531300	447080	.841	.841	5.66	
24					1184	39.66	1223.66		57	4.98	3540		584100	489464	.838			
25					1287	42.61	1329.61		61	4.65	3950		651750	531884	.816			
26	1.00	1.85	1.25	1.75	669	31.74	700.74	40.0	46	6.15	2125	16.00	340000	280296	.824			
27					772	32.98	804.98		53	5.34	2425		388000	321992	.829			
28					875	34.22	909.22		59	4.81	2700		432000	363688	.842			
29					978	35.46	1013.46		65	4.35	2960		473600	405384	.855	.855	4.35	
30	0.84	1.69	1.09	1.75	463	29.26	492.26	40.0	43	6.60	1553	15.84	245995	196904	.800			
31					566	30.50	596.50		53	5.34	1826		291238	238600	.819			
32					669	31.74	700.74		60	4.72	2130		337392	280296	.830	.830	4.72	
33					772	32.98	804.98		68	4.17	2450		388080	321992	.829			
34	0.75	1.60	1.00	1.75	463	29.26	492.26	40.0	61	4.65	1497	15.75	235777	196904	.834			
35					566	30.50	596.50		68	4.17	1816		286020	238600	.834			
36					669	31.74	700.74		83	3.41	2116		333270	280296	.841	.841	3.41	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table b.—Part I.

Wheel No. II.—Chute No. 2.—*Elbow buckets. Close breast. Bottom of gate 14.25 feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	2.25	2.75	3.93	1.25	1287	42.61	1329.61	40.0	67	4.22	4335	16.50	715275	531844	.743			
2					1390	45.56	1435.56		73	3.88	4680		772200	574224	.743			
3	1.50	2.00	3.18	1.25	463	29.26	492.26	40.0	36	7.87	1610	15.75	253575	196904	.776			
4					566	30.50	596.50		40	7.08	1920		302400	238600	.789	.789	7.08	
5					669	31.74	700.74		45	6.29	2275		358312	280296	.782			
6					772	32.98	804.98		54	5.24	2620		412650	321992	.779			
7					875	34.22	909.22		60	4.72	2970		467775	363688	.777			
8					978	35.46	1013.46		68	4.17	3330		524475	405384	.773			
9					1081	36.70	1117.70		74	3.82	3700		582750	447080	.767			
10	1.00	1.50	2.68	1.50	463	29.26	492.26	40.0	35	8.12	1675	15.25	255437	196904	.767			
11					566	30.50	596.50		42	6.74	2000		305000	238600	.782			
12					669	31.74	700.74		49	5.78	2340		356850	280296	.785	.785	5.78	
13					772	32.98	804.98		55	5.15	2700		411750	321992	.782			
14					875	34.22	909.22		68	4.17	3080		469700	363688	.774			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE b.—PART II.

WHEEL No. II.—CHUTE No. 2.—*Elbow buckets. Close breast. Bottom of gate 14.25 ft. above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
15	1.00	1.50	2.68	1.75	566	30.50	596.50	40.0	37	7.65	2015	15.25	307287	238600	.776			
16					669	31.74	700.74		43	6.60	2340		356850	280296	.785			
17					772	32.98	804.98		48	5.90	2660		405650	321992	.793	.793	5.90	
18					875	34.22	909.22		54	5.24	3015		459787	363608	.791			
19					978	35.46	1013.46		66	4.27	3390		516975	405384	.784			
20					1081	36.70	1117.70		73	3.88	3790		577975	447080	.773			
21	0.75	1.25	2.43	1.75	463	29.26	492.26	40.0	46	6.15	1700	15.00	255000	196904	.772			
22					566	30.50	596.50		52	5.44	2025		303750	238600	.785			
23					669	31.74	700.74		55	5.15	2370		355500	280296	.788	.788	5.15	
24					772	32.98	804.98		65	4.35	2740		411000	321992	.783			
25					875	34.22	909.22		73	3.88	3100		465000	363688	.782			
26					978	35.46	1013.46		79	3.58	3445		516750	405384	.784			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE C.

WHEEL No. II.—CHUTE No. 3.—*Elbow buckets. Close breast. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	3.04	4.04	5.22	1.25	978	35.46	1013.46	40.0	46	6.15	4900	13.50	661500	405384	.612	.612	6.15	
2					1081	36.70	1117.70		56	5.06	5650		762750	447080	.586			
3					1184	39.66	1223.66		65	4.35	6410		865350	489464	.565			
4	2.04	3.04	4.22	1.25	772	32.98	804.98	40.0	46	6.15	4100	12.50	512500	321992	.628			
5					875	34.22	909.22		50	5.66	4550		568750	363688	.639	.639	5.66	
6					978	35.46	1013.46		61	4.65	5210		651250	405384	.622			
7	1.04	2.04	3.22	1.75	669	31.74	700.74	40.0	36	7.87	4025	11.50	462875	280296	.605			
8					772	32.98	804.98		44	6.44	4200		483000	321992	.666	.666	6.44	
9					875	34.22	909.22		50	5.66	4790		550850	363688	.660			
10					978	35.46	1013.46		55	5.15	5410		622150	405384	.651			
11					1081	36.70	1117.70		63	4.50	6025		692875	447080	.645			
12	0.79	1.79	2.97	1.75	772	32.98	804.98	40.0	52	5.44	4275	11.25	480937	321992	.670			
13					875	34.22	909.22		57	4.98	4775		537187	363688	.677			
14	0.79	1.79	2.97	2.00	669	31.74	700.74	40.0	44	6.44	3680	11.25	414000	280296	.677	.677	6.44	
15					772	32.98	804.98		48	5.90	4275		480937	321992	.670			
16					875	34.22	909.22		55	5.15	4870		547875	363688	.663			
17					978	35.46	1013.46		63	4.50	5510		619875	405384	.653			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE d.

WHEEL No. II.—CHUTE No. 4.—*Elbow buckets. Close breast. Bottom of gate* 6.96 *feet above bottom of wheel.*

No. of Exper't.	Head of Water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations:
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	3.04	4.21	5.39	1.00	566	30.50	596.50	40.0	41	6.90	4200	10.00	420000	238600	.568	.568	6.90	
2					669	31.74	700.74		49	5.78	5150		515000	280296	.544			
3					772	32.98	804.98		61	4.65	6260		626000	321992	.514			
4	3.04	4.21	5.39	1.25	566	30.50	596.50	40.0	36	7.87	4320	10.00	432000	238600	.552			
5					669	31.74	700.74		41	6.90	4900		490000	280296	.572	.572	6.90	
6					772	32.98	804.98		51	5.55	6100		610000	321992	.527			
7	2.04	3.21	4.39	1.75	566	30.50	596.50	40.0	37	7.65	4400	9.00	396000	238600	.602	.602	7.65	
8					669	31.74	700.74		45	6.29	5310		477900	280296	.586			
9					772	32.98	804.98		56	5.06	6500		585000	321992	.550			
10	1.04	2.21	3.39	1.75	360	28.02	388.02	40.0	38	7.45	3080	8.00	246400	155208	.630			
11					463	29.26	492.26		48	5.90	3900		312000	196904	.631	.631	5.90	
12					566	30.50	596.50		58	4.90	4875		390000	238600	.611			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Quarterly Meeting.

The thirty-third quarterly meeting of the Institute was held at the Hall of the Institute April 19, 1832.

Thomas Fletcher, Vice President, in the chair.

The minutes of the last meeting were read and approved.

The quarterly report of the Board of Managers was read and accepted, when, on motion, it was referred to the standing committee for publication.

The quarterly report of the Treasurer was read and accepted.

The Corresponding Secretary read a communication from the American Institute of the city of New York, accompanied by one hundred copies of the address delivered before that Institute by the Hon. Edward Everett at their last Annual Fair; the address was then distributed among the members of the Institute present.

The committee appointed to inquire into the statistical wealth of the state, reported that the labours of the sub-committee for Dock ward were finished, the tables of which were presented, showing that the value of the domestic manufactures of that district amounted to upwards of seven hundred thousand dollars.

On motion, the thanks of the Institute were presented to the sub-committee for Dock ward for the promptness with which they had attended to the duties assigned them.

On motion, it was

Resolved, That the committee on statistics be authorized to adopt such measures as they may deem adviseable for the purpose of procuring a sufficient amount of funds to defray the expenses that will be incurred in the prosecution of the duties assigned to them.

The following donations were presented to the Institute.

By Messrs. Carey & Lea.

Lardner's Cabinet Cyclopædia, No. 13, *on Silk, and No.* 14, *on Natural Philosophy.*

A Geological Manuel, by H. T. De La Beche.

Renwick on the Steam Engine.

By Profr. Alexander Dallas Bache.

Report of Committee of American Philosophical Society on Astronomical Observations, February 12, 1831.

By Isaac Hays, M. D.

Euclid's Geometry, by Bonnycastle.

Experiments on Anthracite, Plumbago, &c. by Lardner Vanuxem.

By Reuben S. Gilbert.

The Cabinet of Natural History and American Rural Sports, vol. 1.

The Corresponding Secretary laid on the table the following works received in exchange for the Journal of the Institute, viz.

London Journal of Arts and Sciences, for October, November, and December, 1831, and January and February 1832.

Repertory of Patent Inventions, October, November, December, and Supplement, 1831, and January and February, 1832.

Mechanics' Magazine, for September, October, and December, 1831, and January, 1832.

Register of Arts and Journal of Patent Inventions, for October, November, and December, 1831, and January and February, 1832.

Recueil Industriel, for July and August.

Bibliothéque Physico-économique, for September, October, November and December.

Annales de Chimie et de Physique, for June, July and August.

Bulletin de la Societé d'Encouragement pour l'Industrie Nationale, for July, August, and September.

Annales des Mines, 5th and 6th book, 1830.

North American Review, January and April.

American Annals of Education, January, 1832.

Journal of the Philadelphia College of Pharmacy, for January and April.

The American Quarterly Review, for March.

Ladies' Book, for January, February, March and April.

The American Journal of Arts and Sciences, for January.

The Southern Review, for February.

Museum of Foreign Literature and Arts, for January, February, and March.

The Illinois Monthly Magazine, for January and February.

THOMAS FLETCHER, *V. President.*

J. HENRY BULKLEY, *Rec. Sec.*

Thirty-third Quarterly Report of the Board of Managers of the Franklin Institute.

To the Franklin Institute of the state of Pennsylvania for the promotion of the Mechanic Arts, the Board of Managers offer their thirty-third quarterly report.

The closing winter has been, as usual, a season of active usefulness. The lectures delivered regularly by our several professors, have continued to attract attention, and to convey instruction. It is a matter of regret that but few of our members avail themselves of the opportunity of delivering volunteer lectures; a branch of our duties from which much benefit had been expected at the outset of the Institute. Our schools have also continued as announced in our last report, and the Board entertain the opinion of their usefulness and importance that was then expressed.

The investigations commenced by the Institute are continued with all due attention. The experiments on steam boilers have been carried very far, and that part which embraces the properties of steam and the various phenomena which it exhibits under different circumstances, may be said to be nearly completed. Preparations have been made to investigate the strength of the various kinds of iron and of copper used in the construction of steam boilers. To effect this successfully a machine has been constructed under the directions of the

sub committee to which this branch has been intrusted. The expenditure on account of this machine, though considerable, is believed to have been judicious, as it enables us to test the strength of all the different kinds of iron or copper, and at different temperatures; indeed to test the strength of any material which may be used in the arts. This expense will be defrayed from the fund which has been so liberally placed at the disposal of the Institute. In order to derive as much benefit as possible from this machine, the Institute invite their members and the public at large, to send any specimens of iron, &c. the strength of which it is desired to ascertain; they may be directed to William Hamilton, Actuary of the Institute; and the Board pledge themselves that every variety sent will be fairly and strictly tested, under the superintendence of the appropriate committee.

The investigation into the statistical wealth of Pennsylvania has led to some expenses which the Board have been called upon to defray; one hundred dollars have already been appropriated to this purpose, and it appears that there is still a balance of about fifty dollars due to meet past disbursements. In adverting to this fact, and to the circumstance that if the investigation is likely to be useful, it must be at a considerable additional expense for postage, printing, clerk hire, &c., the Board would respectfully submit to the Institute that the funds of the society are so limited in extent, and so imperiously required for other necessary expenditures, that it seems to them desirable to defray the expenses of the statistical investigation from a separate fund, which it is believed could be raised by subscription among those most interested in its result. Probably a sum of $500 or $600 would be sufficient for the purpose, and it is not unlikely that it could be raised by some exertion on the part of the members.

The Board have taken some preliminary steps towards the better arrangement and disposition of their cabinet of models, &c.

All which is respectfully submitted by

William H. Keating, *Chairman.*

William Hamilton, *Actuary.*

Notice of some assertions made by Mr. Joshua Shaw in the Journal of the Institute for September last, on the subject of Percussion Locks for Cannon, by the writer of the article under the signature of Justice.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—The writer of the article signed "Justice," which appeared in your Journal for May last, has recently met with a rejoinder which occupies six pages of the number of the Journal for September last.

It is not designed to travel over the whole of this huge and laboured production, nor to detect and expose the numberless errors of fact and inference with which it abounds. But with your per-

mission, and with due respect for the maxim quoted in your appended note, a few remarks will be offered in reply.

The first publication on this subject, did, in effect, accuse Lieut. Bell of pilfering from Mr. Shaw an invention which he afterwards patented. It was the purpose of "Justice," in his reply to that publication, to repel this foul aspersion, and that purpose was effectually accomplished by reference to dates and documents which are incontrovertible. This point has not been touched, nor even approached, in any of the discursive wanderings of this enormous rejoinder, and hence it is regarded as being wholly abandoned by Mr. Shaw. Here we might rest the matter, and would do so, but for a denial on a collateral point which requires a brief notice.

"Justice" stated that it was a matter of official record, that the principle of applying percussion locks and primers to the firing of cannon, had been suggested to Mr. Shaw by another more than eight years before that time, (April 1831.) This statement is met by a positive denial, and "*Justice*" is thereby accused of falsehood. Mr. Shaw says, "if it be on official record that this invention of mine was communicated to me more than eight years ago, what ignorant individuals must preside," &c. after which he comes directly to the point, and says, "I deny that information was ever conveyed to me from any quarter, that furnished *any*, even the most distant hints of my invention." And then refers to certain experiments made at Frankford, November 20, 1823, in support of that denial. This date is the earliest quoted by Mr. Shaw. Now, let him be asked, if he will dare to deny that these very experiments which he here cites as the foundation and the sustaining prop of all his claims, were not made in pursuance of suggestions communicated to him by another a long while before? Let the following extract from an "official record," answer.

Extract of a letter to J. Shaw, of Philadelphia, dated 12th February, 1823.

"It is contemplated to make some trials in the application of the detonating powder to cannons by means of a lock to be prepared for that purpose, and to be permanently attached to the gun. I have to request that you will prepare a few primings for this purpose. I conceive that the copper caps should be much larger for cannon, than those for small arms, and they should contain about three times the quantity of powder. The primings for cannon must necessarily be much stronger, because the fire must be transmitted a much greater distance, (say six or eight inches,) and must penetrate the flannel bag which contains the powder. These circumstances should be taken into consideration, and provided for, in preparing the primings. It will be necesary also, that the lock should be proportionably strong, which will be attended to when made."

It should be borne in mind that this letter was written at a time when the application of detonating powder and percussion locks to the firing of *small arms* was well known and in general use. The

application of the same principle to the firing of *cannon* was first suggested in that letter; or, it is at least the first known to the writer; if there be any of earlier date, let it be shown by Mr. Shaw.

JUSTICE.

April, 1832.

Note by the Editor.—The note to which our correspondent alludes will be found at page 159 of our last volume. It was then supposed that if any rejoinder was offered to the remarks of Mr. Shaw, it would immediately have followed the publication of his article; the removal to a distant part of the Union of the gentleman who writes under the signature of *Justice*, prevented his seeing Mr. Shaw's last communication, and has consequently delayed the appearance of *this final* notice.

Decision of the Supreme Court of the United States, in a case involving the question of the Validity of a Patent, which has been surrendered and reissued on an Amended Specification.

It has been the practice in the Patent Office to allow a patentee to surrender his patent, in order to allow of his amending a specification which through inadvertence, or a want of information respecting the requirements of the law, had been defective; the reissued patent, in such cases, always bearing the same date with the original patent. No formal decision, however, had taken place in the courts of the United States, establishing the correctness of this procedure, in regard to which the law itself had not made any provision. This question has been finally settled at the recent term of the Supreme Court.

The case which brought this question before the court was that of E. & H. Raymond *versus* Grant & Townsend.

This was an action to recover damages for an infringement of the right of the plaintiff, Joseph Grant, under a patent granted in April, 1825, a former patent for the same thing having issued in August, 1821, but which having been surrendered owing to a defective specification, had been cancelled of record, and the second issued to continue for fourteen years from the date of the first.

One of the pleas filed by the defendants was that the specification did not correctly and accurately describe the improvement claimed, that it did not furnish any account of the sizes or proportions of the respective parts of the machine, nor describe its manner of operating in those full, clear, and exact terms required by the law. The plaintiffs, in reply, aver that neither their description, or the drawings annexed thereto, are in any way deficient.

On the trial, the counsel for the defendants objected that the Secretary of State had no power by law to accept a surrender of, and to cancel, said letters patent. The court, however, decided that such surrender might be made, when the defect arose from inadvertence

or mistake, and without any intention of fraud on the part of the patentee. To which decision the counsel for the defendants excepted.

After adducing testimony, the counsel for the defendants moved the court to instruct the jury that if the specification was proved to be defective, that they must find for the defendants; which instructions the court refused to give, but instructed the jury that the patent would not be void on account of such defect, unless it arose from design, and for the purpose of deceiving the public. To this opinion the counsel also excepted.

The jury found a verdict for the plaintiffs, and assessed the damages to $3266 66, the judgment on which was brought before the Supreme Court, by a writ of error.

In giving its decision in this case, it was observed by the court, that "the first question in the cause, respects the power of the Secretary of State to receive a surrender of a patent, and to reissue it under an amended specification for the unexpired part of the term. The court was of opinion that although the law did not make any direct provision allowing of such a surrender, and the reissuing of a patent under an amended specification, yet such a proceeding seemed to accord with its general spirit. That the public still obtained every thing which was intended to be secured to it; and that the sense of justice and of right which all feel pleads strongly against depriving the inventor of the compensation solemnly promised to him, because he has committed an inadvertence, or innocent mistake. Every one, it was observed, would acknowledge the propriety of issuing a new patent, if an error had been committed in the Department of State, yet this would be done without any thing in the law to authorize it; and why should not the same step be taken for the same purpose, if the mistake has been innocently committed by the inventor himself? The executive department, it is understood, have acted upon the construction adopted by the Circuit Court, and have considered it as settled. We would not willingly disregard the settled practice in a case where we are not satisfied it is contrary to law, and where we are satisfied that it is required by justice and good faith."

This is the only point involved in this case which we deem it necessary to lay before our readers at present, as we shall hereafter republish in this journal our Digest of the Decisions of the United States in Cases arising under the Patent Laws, made by order of Congress, and published with the general list of patents. When we do this, we shall append thereto such further information and remarks, as subsequent decisions, and the amendments which may be made to the patent laws, may render necessary.

EDITOR.

Bibliographical Notices.

Lardner's Cabinet Cyclopædia.

Hydrostatics and Pneumatics, by the Rev. Dionysius Lardner, with Notes by Benjamin F. Joslin, M. D., Professor of Natural Philosophy in Union College. First Am. from 1st Lond. Ed. Carey & Lea. 1832.*

This is the thirteenth number of the excellent series of treatises comprised in the Cabinet Cyclopædia, the republication of which in this country we owe to Messrs. Carey and Lea. If called upon to state our preference of one or other of the two treatises on Natural Philosophy, namely, of the Mechanics or of the Hydrostatics, we should pronounce in favour of this latter work. The style is more popular throughout. Each step in the subject is explained by reference to a supposed experiment, and thus the reader has before him a representation of precisely what the author means to convey by his proposition. The mind is in this way led forward from the consideration of the more simple truths to the complex phenomena of both Hydrostatics and Pneumatics.

When so much depends upon the figures illustrative of the text, it is to be regretted that the publishers have given such inferior cuts: we have rarely seen worse specimens of the art than some of them afford. The models from which they were taken in the English work are not remarkable for either great accuracy or elegance, but in the latter quality, if not in the former, they surpass the American copies.

The publishers have taken the pains to secure an editor for the American edition of this work. In running over the text we observe that many errors of inadvertency in the English edition are corrected, and some which can hardly admit of the application of so mild a name, pointed out in the notes at the foot of the page. We could have wished that whenever the author was certainly wrong the American editor had altered the text without involving the reader in any discussion, permitting him thus to suppose that there could be two views taken of the subject. The American editor has taken this course in the tables pages 217 and 218, which were altogether incorrect in the English edition, and which are made accurate in this, (if we except one typographical error,) without noticing the change.

It would be but an ungrateful task to point out trivial errors in the figures and text which remain uncorrected, and having holes in our own coats requiring mending, we would be chary in pointing out those in the garments of our neighbours. We will even resist a disposition to criticise the sphere said (page 15) to have a bottom, a top, and sides, which has escaped the eye of the American editor, and the contracted vein (fig. 68) with *diverging* sides.

Such errors speak for themselves, and throw but little impediment

* Com. Pub.

in the way of a clear sighted reader. The readers of our journal would probably include in this class also the sixty pounds pressure upon a square inch, which they are told (page 37) by Dr. Lardner "considerably exceeds that which is produced in most high pressure steam engines." There are inaccuracies, some of which, as calculated to impress erroneous conclusions upon readers, we will notice.

First, then, the remarks on page 85, where, as the basis of reasoning, is assumed what is now known not to be true, that salt water has a point of maximum density. To be more explicit, that at a certain temperature, salt water is denser than at either higher or lower temperatures. The remarks of Dr. Lardner are very philosophic as applied to collections of fresh water, the limited depth of which renders the provision of which he speaks of immense importance.

Such is not the case in regard to the ocean, of which the great depth, and the interchange of the cold and dense waters of the polar seas, with the warmer and lighter waters of the equatorial regions, prevent any very considerable reductions of temperature. The anomalous action is not needed in the ocean, and there we do *not* find it.

We object also to the idea that "*pure*" mercury (page 196) can be obtained by straining the impure metal through chamois leather, and that no other purification is required to rid the metal of the "*solid*" substances which it takes up. If alloyed with lead, tin, or bismuth, which would materially affect the specific gravity of the metal, and therefore its use in the barometer, the straining through chamois leather would not remove the impurities, and recourse must be had to the action of dilute sulphuric acid and to distillation.

In the preparation of calomel much distilled mercury is obtained which allows it to be sold at a lower price than if the process of distillation had been resorted to expressly to procure the metal. It is much to be wished that this pure mercury were substituted in the barometer especially, but also in the thermometer, for the ordinary mercury employed.

The theory of the lifting pump, given page 239, is strangely incorrect. The author supposes the piston of the pump to be loaded in making the upward stroke with a column of water, having for its height the distance from the valve in the piston to the level of the water in the pump. That this cannot be the case is readily seen, since the water in the cistern would certainly rise to its level within the body of the pump. The piston of the pump is urged *upwards* by a force due to a column of water between the piston and the level of the fluid in the cistern, it is urged *downwards* by the column stated by Dr. Lardner, and hence the resulting downward pressure is the column between the level of the fluid in the cistern, and the level of that in the pump.

On the very next page, (240,) we find a pump with a solid plunger classed as a "lifting pump," though the action of the machine *forces* water which has risen into the barrel of the pump in the upward stroke of the plunger, by the downward stroke, into an adjacent tube having a valve at the bottom. The pump is, in few words, a peculiar form of the forcing pump, with a solid plunger.

These few remarks will, we trust, be turned to account in a second edition, by drawing the attention of the American editor more particularly to the fact that errors do really exist in the work, besides those which he has corrected.

Meanwhile we would recommend those who are fond of such reading, to procure the book without fear that the inaccuracies will weigh a feather when compared with its merits. B.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN NOVEMBER, 1831.

With Remarks and Exemplifications, by the Editor.

1. For an improvement in the *Tanning Apparatus;* William Brown, Mooresville, Delaware county, New York, November 2.

The present patent is taken out as an improvement on the apparatus patented by the same gentleman, November 11th, 1830, and consists in a method of removing the refuse bark from the letches without the ordinary labour of shovelling. Those who are interested may refer to our account of the original patent.

There is to be a plug passing through the false bottom, and fitting closely into the true bottom of the letch, closing an opening through which its contents may be discharged. When this is to be effected the letch is filled with water from the reservoir, the contents are then agitated so as completely to stir up the spent bark, when, on withdrawing the plug, the bark and water will run out together through a trunk fixed for that purpose.

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2. For an improved *Wheel for a Rail-road Car;* Samuel Krauser, Reading, Bucks county, Pennsylvania, November 2.

We have here another edition, *without improvements*, of Garnett's friction rollers. These rollers, or wheels, are to be connected together by a ring through which their axes pass; between these the axle of the car is to work, whilst they fit within the rim of the main wheel, which forms a box to receive them.

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3. For a *Tri-cylinder Machine, operating by Water fall;* Eugene Berganzio, city of New York, November 2.

We begin with the end of the specification of this machine, which although it is not in the form of a claim, assures us of the great value of the invention, by informing us that "two horses will consequently produce the power of twelve." After this, if it is expected that we shall give a particular description of the machine, that expectation will be disappointed. All we shall say is, that two horses, walking in a hollow drum, are to raise water enough, in buckets, to drive a water wheel which shall have the power of twelve horses.

We would suggest an improvement to the patentee, which is, either to shoot, or otherwise dispose of, his horses, as soon as he has

fairly set his machine to work, as the water raised by them will still leave the power of ten horses, every two of which may be made to operate upon a machine similar to his first, and thus produce the power of sixty horses, the principle being, of course, applicable *ad infinitum*.

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4. For a *Machine for Drilling or Boring Stone;* William Holdridge, city of Albany, New York, November 2.

Drills, made in the form usually employed for the above purpose, have their shafts passing up through holes in guide pieces, which retain them in their vertical position. The shafts are attached to spring poles, which serve to raise them; and by means of a rope descending from each pole the shaft attached to it is worked up and down. These parts, with a frame to sustain them, constitute the whole machine, no provision whatever being made for the necessary operation of turning the drill as the strokes are repeated. There is no claim made, excepting to the using of any number of drills, and to the making the machine of any size, shape, or material best adapted to it; a right which will not be disputed.

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5. For an improvement in the *Manufacturing of Axes;* Erastus Shaw, and Robert H. Burk, Canton, Hartford county, Connecticut, November 3.

Rollers are to be prepared and geared in the manner of flatting mill rollers; one of these is to be indented; and the other is to have a raised part upon it, leaving, between the two, a proper space for the formation of the axe, so that when bent over, the eye and other parts will have their proper shape. The iron, properly heated, is to be passed between these rollers, and when delivered from them subjected to the action of a press, provided with a punch, or follower, for bending the parts together.

The claim is to the forming the parts of axes by means of rollers, and of doubling them together in a press.

The description is equally general with our notice of it, "the *particular* form of machinery used to carry these principles into operation being deemed unessential." We, however, do not concur with the patentee on this point, for the *general principle* of such a machine is well known, numerous articles having been manufactured of iron by means of rollers; we apprehend, therefore, that to sustain a patent for such a purpose, there ought to be something *special* in the construction of the apparatus, and that such special contrivance should be clearly exhibited.

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6. For a *Composition to be used in the Stiffening of Hats;* Charles Bent, and Francis Bush, Chelmsford, Middlesex county, Massachusetts, November 3.

The materials to be employed in forming an elastic, water-proof stiffening for hats, are borax, rosin, shellac, and copal. Eight ounces of the first, one pound of the second, two of the third, and five ounces

of the last, are to be dissolved in five quarts of hot water, the ingredients being put into it in the order stated. The hat bodies are to be saturated with this compound, and then trenchered, leaving the larger portion of the stiffening in the brim. After standing half an hour they are to be put into a weak solution of sulphuric acid, and then soaked in cold water until all the acid is removed, when they are ready for napping.

The patentees state that this process is much cheaper and better than those usually followed, and that by its aid a workman can stiffen three times the number that can be stiffened by the usual method.

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7. For a composition of matter for the *Cure of the Gout and Rheumatism;* William A. Parker, Bellhaven, Accomack county, Virginia, November 4.

This composition of matter is called "Parker's compound vegetable spirit," which is to be extracted from sassafras root and ground ivy. A still is to be filled with "as much of the root," clear water, and about five pounds of ground ivy to the hundred gallons. This is to be boiled for about thirty minutes, removing the scum which rises. About ten gallons are then to be distilled over for every hundred in the still, and when one-sixteenth of 5th proof brandy is added, this spirituous composition of matter is fit for use, and the patient is to take a wine glass full, two or three times a day.

We have no doubt that the foregoing is quite as harmless and as useful as the generality of quack medicines; one thing is certain, its active properties reside in the fifth proof brandy, and so far as grog, or weak toddy is an antidote to gout and rheumatism, the receipt of *Dr.* Parker must be good. We, however, should agree with the members of the temperance society in the opinion that the smaller the dose, the better.

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8. For an improvement in the *Tanning of Leather;* Abraham Conwell, Connersville, Fayette county, Indiana, November 4.

There are to be tubes of communication between each of the vats employed, which are opened or closed at pleasure by means of cocks fixed within the strainers, or leach eyes, and also with a cistern which forms a common reservoir from each of them. The claim is to "the application of the conductors and pipes to the vats, by means of which much labour and bark are saved in the business of tanning." Conductors and pipes have been repeatedly used; we have seen them many years since; not precisely as described by the present patentee, but operating upon the same principle, and answering the same end.

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9. For a machine for *Thrashing Grain,* and cleaning it from smut; Henry Spencer, Maryland, Otsego county, New York, November 7.

The cylinder of this machine is to be of solid wood, one foot in diameter, with beaters upon it, which are also to be of wood, and to consist of pieces one foot in length, and one and a half inch in di-

ameter. In an ordinary sized machine there will be forty-eight of these beaters, standing at right angles to the cylinder, and set so as to form a spiral line round it. The concaves, feeders, &c. vary but little from those commonly used, and we are not told in what the improvement consists, there being no claim.

10. For an improvement in the *Manner of straightening the Toggle Joint in the Hand Printing Press;* Otis Tufts, Boston, Massachusetts, November 7.

The combination of levers and joints shown in the drawing which accompany this specification, constitutes the claim to a patent; a good idea of this cannot be given in words alone, and we therefore omit the form of the claim. We have had occasion, more than once, to describe variations in this particular apparatus; the relative merits of the different plans cannot be otherwise settled than by direct experience.

11. For an improvement in the mode of manufacturing *Mattresses, Sofas, and other articles;* Rowland Cromelien, city of New York, November 7.

The mattress here claimed is as nearly like that described at page 128, patented by Mr. French on the 25th of August, as one mattress can well be like another; and if claims can be sustained for differences so small, every man may readily become an inventor, and secure his invention by patent. To the public, however, this will be a point of little importance, provided they obtain a good article, and do not pay any thing for the pretended improvement.

12. For a process by which the *Borings, Drillings, Filings, or Turnings of Cast Iron are rendered available in the Furnace;* Magradier Mason, Georgetown, District of Columbia, November 8.

(See specification.)

13. For an improved *Rotary Steam Engine, or Pump;* Oliver Allen, Norwich, Norwich county, Connecticut, November 8.

The attempts at rotary steam engines have been so numerous, that it is scarcely to be expected that any other than new modifications, and methods of obviating the difficulties which have attended their use, should be now brought forward. The present engine, in its general structure, resembles others which have been previously patented, and this is stated by the patentee. There is to be a revolving drum, with a stationary head. Valves are opened and closed by a circular guide piece, so curved as to effect this object in the desired manner. One of the improvements proposed is the making depressions in the head of the revolving drum, or cylinder, over which depressions the edges of the valves pass; these allow the steam to escape at the moment the valve begins to rise, and thus relieve it from the pressure which would impede its opening. Another part claimed as

an improvement is the employment of three cocks in a steam box, the keys of which cocks are geared together, so that one lever acts upon the whole; these cocks serve to cut the steam off, or to admit it at either of two openings, so as to stop or reverse the motion of the engine. The following claim notices these and other parts viewed as new. "1st. The manner of fixing and adjusting the circular guide plate for opening and closing the valves. 2nd. The excavations made in the fixed head for relieving the valves from the pressure of the steam before they commence rising. 3d. The mode of giving a lateral adjustment to the cylinder by means of the circular plates inserted into the ends of the casing, and which bear upon the shoulders of the shaft. 4th. The employment of, and the manner of fixing the three cocks for the admission and discharge of steam, when used as a steam engine. 5th. The packing in the grooves of the fixed head, by means of circular metallic rings, borne up by elastic packing, or by springs."

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14. For an improvement in the *Apparatus used for heating Hatters' Irons;* Daniel L. Tuthill, city of New York, November 8.

This furnace is very simple in its structure, and is to be made wholly of metal. The fire place is a cylinder of eight inches in height, and the same in diameter, with a grate at the lower end, and two bars above to support the irons, being exactly like the common cast iron furnaces. The cylinder is to be placed in an iron box, or oven, like that of a common cooking stove, having a hole through its bottom to allow the cylinder to pass through, until it rests upon a rim, or flanch, surrounding its upper edge. The oven is closed by a door, and has a pipe leading from the top, and furnished with a damper to regulate the draft.

The claim is to "the general construction and *application* of the furnace above specified, for the *above mentioned purposes.*"

The *general* construction has certainly but little of novelty in it, nor do we think it very good. The furnace part, if made of clay, brick, or other bad conductor, would be more economical, and less annoying in warm weather. As to the "*application*" to the "*above mentioned purpose,*" we apprehend that if the tailor may heat his goose, and the laundress her flat irons, at such a furnace, the hatter may take the same liberty, either with or without a patent therefor.

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15. For an improvement in forming the *Pavement of Streets,* for which a patent issued to John L. Sullivan, Engineer, of New York city, on the 20th of October, 1831, which patent has been surrendered and cancelled on account of a defective specification, and reissued November 9.

The principal difference between the present and former specification consists in the drawing up of the new one with much greater precision than the former, and in the direct mentioning that instead of finishing with the water cement, the patentee sometimes, after the

lower stratum of water cement is dry, fills the upper part of the interstices with fusible mineral cement, applied boiling hot, forcing fragments between the stones, as in the former instance.

For our notice of this patent when first issued, we refer to p. 236, in the number for last month.

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16. For a *Thrashing Machine;* Johnson Dawkins, Westport, Oldham county, Kentucky, November 10.

This machine operates by means of flails fixed in rows upon each side of a thrashing floor. The thrashing floor is an inclined plane down which the article to be thrashed is made to pass, the flails operating upon it in its descent. The floor is formed of slats which allow the grain to pass through on to a spout which conducts it down to a winnowing machine. The wheel work and levers by which the flails are to be moved, are placed under the inclined floor.

The claim is to "the before described machine, but particularly the vibrating frames of flails or beaters; the mode in which they are vibrated; the inclined floor, and the openings and spouts for conveying the grain to the winnowing machine."

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17. For *Looking glass back ground to Pictures or other Ornaments;* Isaiah Jennings, city of New York, November 11.

(See specification.)

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18. For a process for *Dying Cotton in the Staple, or Cotton Wool;* James Roy Stewart, Lowell, Middlesex county, Massachusetts, an alien who has resided two years in the United States, November 11.

The object of this patent is to prepare the cotton wool for entering into the composition of cloths of mixed colours. When the cotton has been carded, the laps, or sheets, as they are delivered from the machine, are to be loosely folded so as to bring the extremities nearly together; they are then to be placed between coarse sheets, or secured in any similar way, allowing the contact of water; the cotton thus secured is to be boiled in water for about four hours; the laps are then to be dyed in the manner in which yarn is usually dyed; the boiling, it is said, will prevent all shrinking and matting in the process of dying, and thus remove the difficulty which has heretofore existed in preparing it to be used in mixed cloths.

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19. For a *Machine for Mixing Mortar;* Andrew Kirkpatrick, Urbana, Champaign county, Ohio, November 12.

This machine is designed for mixing mortar for bricklayers, or clay for potters. Two vertical shafts are made to revolve in an oblong tub, with circular ends; the shafts have knives, or breakers, passing through them, which, by their revolution, divide and mix the materials; the knives of one shaft are so fixed as to pass between those of the other. There is to be a hopper above the tub into which the materials are to be placed, and under this a seive, and trough, or chute;

the cog wheel by which the shafts are made to turn, is furnished with cams which agitate the seive. The tub is to contain water, and as the materials fall into this, the revolving knives, or breakers, agitate and mix them.

The claim is to "the foregoing machine, particularly the vertical shafts containing the knives or breakers, and the cams on the double faced cog wheel for shaking the riddle."

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20. For *Elliptical Steel Springs for Carriages;* Charles Hinkle, Northampton Township, Lehigh county, Pennsylvania, November 12.

This elliptical steel spring is, in form, the double bow spring, which we see in use every day, and many times a day. The only *novelty* appears to be that each bow is to be a single plate of steel, instead of several plates one upon the other. "The *invention* here claimed is in making steel springs for carriages of two plates of steel bent to any curve, placed upon each other, and fastened at their ends by lapping, and with rivets, or bolts, and thus forming elliptical springs."

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21. For an improvement in the *Machine for Spinning Cotton or Wool;* Levi Rice, Milburn, Somerset county, Maine, November 14.

It appears, judging from the drawing, if such it may be called, that this is intended as a domestic spinning machine, as it is represented as carrying eight spindles only. The band which drives the spindles appears as though it pressed against their whirls, which it is made to embrace by being carried round a roller between each spindle, *a*, *a*, *a*, being the spindles, and *b*, *b*, *b*, the rollers, which are, we suppose, what are designated friction wheels by the patentee.

He claims "the putting any number of spindles in motion by one band, by the improvement of the friction rollers, consequently the yarn or thread on each spindle is twisted exactly even, or alike, which cannot be done with a band to each spindle."

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22. For a *Machine for Planing and Dressing Boards, &c.* John W. Newberry, Avon, Livingston county, New York, November 15.

The plane used in this machine has cutting irons fixed in the ordinary manner; but, being intended to cut by its motion in both directions, it has two irons which have inclinations the reverse of each other. The stock has two faces, the planes of which form an obtuse angle at their union in its middle. The plane is made to tilt as it passes backward and forward, so as alternately to bring each face, and cutting iron, on to the board or plank. There is a frame work above with cog wheels, and a rack and pinion, with their necessary appendages for working the sliding frame with the plane, back and forth. There are also proper contrivances for holding the board;

the whole of these are well represented in the drawing which accompanies the specification, to which there are ample references.

There is no claim made, and as the machine is not similar to any other for the same purpose with which we are acquainted, this may not be of any importance.

From its structure, it appears to be calculated for short stuff only, and we think it too complex for general use, even for such stuff. In the greater number of cases, a plane of the ordinary construction, especially in roughing out, will tear the stuff in working in one direction, and indeed, the cases are rare in which even a smoothing plane may be used indifferently either way. This objection must lie against most of the planing machines in which the cutting is not done in a curve.

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23. For a *Self-regulating or Self-directing Rail-road Car;* Lewis Wernwag, Harper's Ferry, Jefferson county, Virginia, November 15.

This car is to have four wheels fixed in the usual way, and half way between these there is to be another pair of wheels of smaller diameter, which last, are the regulating, or guiding wheels. The fore and hind axles run in frames connected together by coupling poles, like those of a common wagon, but of equal length, so as to meet in the centre. The guiding wheels are to operate upon the coupling poles at their point of junction, forcing them laterally, according to the curvature of the road. In the drawing, these guiding wheels are represented as about four-fifths of the diameter of the main wheels. They are connected together by means of a slender iron axle, which has its main bearing in a box at its centre; there are shoulders upon the axle by which it is made to act upon the poles which are connected with the box, or bearing. The guiding wheels are furnished with flanches, like the main wheels, and when the road is curved, these flanches, touching against the edges of the rails, cause the ends of the coupling pole to keep in the centre between the two rails.

There is a jointed lever attached to each side of the carriage, furnished with boxes to receive the axle of the regulating wheels, in order to steady it, whilst they allow it to slide freely endwise.

The claim is to the described method of making rail-road carriages with self-directing wheels and axles, however applied.

Where a road is considerably curved, the vertical edge of the flanch of the guide wheel, acting upon the vertical edge of the iron rail, will occasion much rubbing friction, which will cause them to wear with considerable rapidity. Should this objection prove to be of little moment, the principle upon which they act is undoubtedly good.

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24. For a *Thrashing Machine;* Philip Shaffer, Richmond Township, Bucks county, Pennsylvania, November 16.

"The improvement claimed is the fixing the iron pins, or pick-

ers, firmly in the bars placed on the cylinder, and the removing of one piece of the cast iron bed, and substituting the board to preserve the straw."

The machine is, generally, like its neighbours; some of which, we presume, have the iron teeth fixed *firmly*—at all events, the present patentee does not indicate any new way of doing this. His mode of preserving the straw untangled, we do not quite understand. He says, however, that it is effected by removing a part of the cast iron bed, or curve, under the cylinder, and placing a board to receive and guide the straw.

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25. For *Combined Grist and Saw Mills;* Noah Porter, Boston, Massachusetts, November 17.

The shafts of circular saws, and the spindles of grist mills are to be driven by pinions geared into the same horizontal spur wheel. There are, of course, the necessary fixtures for performing the required operations, but these do not present any thing in the slightest degree new. The patentee appears to be of a similar opinion, as he claims "the general arrangement of the before described combined grist and saw mills, and the mode of throwing the saw mill in and out of gear by the levers, or elevators."

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26. For a machine for *Washing and Wringing Clothes, and for Heating Water;* James Luckey, Troy, Rensellaer county, New York, November 19.

This machine consists of an oblong box, divided into three compartments, in one of which the water is to be heated; the clothes are to be washed in the second, and wrung in the third. A furnace of metal is to be let into one of the compartments of the box, and is to be secured to it by the aid of a flanch. The water in this compartment surrounds the furnace, the smoke being conducted off through a pipe rising from the back end of the furnace. The washing compartment, which is in the centre, is about twenty inches square; in this is to be placed a fluted rubbing board, on the ordinary construction; a rubber, consisting of two or three rollers held in the hand, by means of its frame and handle, is to be passed over the clothes held upon the rubbing board.

The wringing compartment, which is at one end, contains a strong netting, or coarse cloth, attached to a shaft which may be turned by a handle or crank. The clothes to be rinced are placed in this cloth, or netting, and on turning the shaft, by means of the handle, they are twisted round it and the water squeezed out of them.

The claim is to the mode of heating the water; the apparatus for wringing; the rubber, and the general arrangement of the several parts.

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27. For an improvement in the *Machine for polishing and graining, or dicing Morocco, or other Leather;* patented on the

20th of April, 1831; Robert Emes, Boston, Massachusetts, November 21, 1831.

We gave an account of this machine when first patented, which will be found at page 164 of the last volume, with a reference to some machines for the same purpose previously patented. The present specification describes the whole machine, without designating the parts which constitute the improvement. The patentee observes, that by comparing the present specification and drawing with the former, it will be found that there are parts not described in the original, and that these constitute the improvements which he now claims. We do not think that it ought to be left to others to discover what a man patents, but that he should clearly point out in what his claim consists. Two machines which are essentially alike in principle, may differ in a way which would not become the proper subject of a patent. It may, for example, be found necessary to brace a machine more effectually, or to make some part of it stronger than was at first done, and these alterations might constitute real improvements in one sense of the word, although not in another. The patentee should tell us, therefore, whether his improvements extend to the mere fact of arrangement, or include what may be called a new principle, or mode of action, and in what part this new principle, or mode of action, is to be found.

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28. For an improvement in the mode of *Scouring, Smoothing, Burnishing, &c. all kinds of Tanned Skins*, or Leather; Robert Emes, Boston, Massachusetts, November 21.

This machine is intended to perform several operations in the leather manufacture which have hitherto been performed by hand, such as scouring, cleansing, striking out, putting out, smoothing, brushing, dressing, and finishing. The present machine is précisely similar in its general construction to that referred to in the last article, but it is made to carry brushes, sleckers, and substances covered with cloth or felt, adapting it to the performance of the operations above enumerated; these occupy the place of the flint, or other polishers, used in polishing, graining or dicing.

The claim made is not to the brushes, &c. but to the mode of using them by means of the machinery described; the brushes and other instruments attached to the wheel, or revolving arms, being similar to those ordinarily used in the hand.

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29. For an improvement in the *Bedstead* called the "Metamorphoric Alleviator," for which a patent was obtained on the 25th of October, 1830; Jonathan Lowe, Whitesborough, Oneida county, New York, November 21.

The bedstead, it appears, remains essentially the same as under the former patent, but the elevating process, which was originally performed by means of rollers, cords, and pulleys, moved by a crank, is effected, in the improved bedstead, by wheels and axles, using either straps, cords, or chains, or other means of fastening them to-

gether, and pinions, ratchets, segments, or other means of changing the position.

All this, it is true, is rather indefinite, but for this we are not answerable, the defect being in the specification.

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30. For a *Chemical Water Proof Cement* for preserving brick and wood work from the injurious effects of water; Charles Fletcher, Boston, Massachusetts, November 22.

The composition here prescribed is a mixture of three quarts of hydraulic cement, two of calcined plaster of Paris, one of unslaked lime, ground; a quarter of a pound of copperas, pulverized; and half a pound of litharge, or red lead. The plaster, we are told, must be calcined in an air tight vessel, and when the above ingredients are mixed together, there must be added half a gallon of boiled linseed oil, the same quantity of spirits of turpentine, and a gill of sour ale or beer. These ingredients are to remain together for two or three days; they are then to be ground, and after being brought to a proper consistence by adding equal parts of boiled oil and turpentine, the work is to be covered with two or three coats of the mixture, laid on by a brush. When a darker shade is wanted, Roman cement is to be added until the desired colour is obtained.

There is no claim made, and, of course, the patent is restricted to the composition exactly as described, a composition which, if it possess the good qualities ascribed to it, may be varied, not only without injury, but probably to advantage.

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31. For a *Thrashing Machine;* Waldren Beach, city of Philadelphia, Pennsylvania, November 23.

A cylinder is to revolve within a curve, and the other parts of this machine strongly resemble such as we have often described; the so called improvements are not of that striking or tangible character as to require particular notice, as they consist mainly in the method of putting the machine together.

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32. For an improvement in *Saw Mills;* Rufus Eaton, Concord, Erie county, New York, November 24.

This machine exhibits a very complex combination of wheels, pinions, and racks, for moving a carriage which supports a circular saw for sawing timber. The improvement particularly claimed is the moving the frame which carries the saw, instead of moving the timber in the usual way.

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33. For a *Cure for Dropsy and Epilepsy;* John S. Fall, Rattlesnake Spring, Morgan county, Georgia, November 25.

The plan of treatment designated in this patent, will, we are told, cure anasarca, ascites, hydrothorax, pericardial dropsy, dropsy of the scrotum, and hydrocephalus internus, producing in adults epileptic affections and mental derangement.

In the first place a tea is to be made by boiling an ounce of Sene-

ca snake root for an hour in a quantity of water, sufficient to make a quart. In this an ounce of saltpetre is to be dissolved; two ounces of this tea is a dose.

A pint of tea is to be made by boiling three drachms of purple foxglove in water. Of this half an ounce is a dose.

After administering aperient medicine, if necessary, a dose of each of the teas is to be given alternately every hour for ten hours in succession, for two or three days; they are then remitted for a day and a half, and resumed, but not continued as long as at first. Pills of one and a half grains of calomel are then to be given morning and night, until slight ptyalism is produced, soon after which the teas are to be resumed, which third course of the teas is generally sufficient for the cure. In case of debility, tonics are to be administered. Should the cure not be completed by the first course, it is to be resumed, and carried to the necessary extent.

We do not know whether the patentee writes M. D.; his specification, however, is drawn up with much more intelligence than those in general which relate to quack medicines, or empirical practice. Whatever of fame or wealth he may acquire by the use of his patent, we doubt, very much, his growing rich by the sale of rights to practising physicians.

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34. For an improvement in *Coach Steps;* George Carter, Newark, Essex county, New Jersey, November 26.

The specification of this patent consists of eighteen words only, communicating the information that the improved coach steps are to be made of malleable cast iron.

Should the validity of this patent be tested in a court of law, the gentlemen of the bar would not, we apprehend, imitate the brevity of the specification; and it might, as has been frequently the case, be found much more easy to claim than to hold a thing. The manufacture of malleable cast iron has, in England, during the last ten or twelve years, embraced the greater number of articles which were formerly made of wrought iron, and, according to the assumption in this, and similar patents, every kind of article so made might have been patented. The *process*, when new, was a proper subject for a patent, but not the individual articles subjected to it.

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35. For a *Machine for Painting Cloth;* Otis Ferrin, Lansingburg, Rensselaer county, New York, November 28.

This machine is in the form of a trough, or hopper, which is to contain the paint. Its bottom consists of a straight piece of timber, covered with leather; one side of the trough, which is called the knife, consists of a board sliding in grooves, and borne down by springs, in order that its lower edge may press upon the cloth as it is drawn through. A roller, on each side of the piece which forms the bottom of the trough, supports the cloth; a stick is attached to the end of the cloth, and to this stick ropes are fastened, leading to a windlass, situated at the distance of the length of the piece; this windlass serv-

ing to wind the ropes, and draw the cloth along. The parts claimed are the inclined board, forming one side of the trough, the springs, and the rollers.

Specifications of American Patents.

Specification of a patent for rendering Borings, Filings, &c. of Iron, available in the Furnace. Granted to Magnadier Mason, *Georgetown, District of Columbia, November* 8, 1831.

I take the borings, drillings, filings, or turnings, and subject them to the action of a powerful press, or to repeated blows from a tilt hammer, drop press, ram, or to the action of any of the well known machines or instruments by which the particles may be forced together and made to adhere, so as to form lumps partially consolidated. In doing this, every competent workman will be aware that the particles to be acted upon must be confined in a box, or mould, to prevent their being scattered by the pressure, or the blow, to which they are to be subjected. The lumps, or masses, of iron so formed, are placed in a furnace, and treated in the same way in which pig or other iron is treated when it is to be fused, or rendered available.

What I claim as my invention, or discovery, is the bringing the particles of iron which are produced in boring, drilling, filing, or turning, into lumps, or masses, by subjecting them to the action of any machine, or instrument, calculated to effect that object, and thus bringing them into a state from which they can be readily fused, or rendered available, as hereinbefore set forth.

Magnadier Mason.

Specification of a patent for Looking Glass Back Grounds to Pictures or other Ornaments. Granted to Isaiah Jennings, *city of New York, November* 11, 1831.

To all whom it may concern, be it known, that I, Isaiah Jennings, of the city of New York, have invented a new and useful mode of forming back grounds to pictures, and ornaments of various kinds, which I call the looking glass ground, and that the following is a full and exact description of my said invention.

The end to be attained is the formation of an aerial back ground to pictures and other ornamental articles, by which they receive an appearance of more perfect relief than by any mode of procedure hitherto known. This I effect in different ways, but all intended to give a looking glass back ground to the picture or ornament. I sometimes take a plate of glass which has not been silvered, and I draw upon it such portrait, picture, ornament, or device, as may be desired, in one or more colours; or I stain or enamel the same upon the glass, and after such picture or device is finished, I proceed to silver the glass, on the same side with the picture or device, in the ordinary

way of silvering looking glasses. Or, instead of silvering the glass upon which the picture or device is painted, I place behind it a plate of looking glass, securing the two glasses in any suitable frame, the painting, or device, inwards.

When the picture or device is formed upon paper, or any other material which can be cut out, I carefully cut the said picture or device from its ground, and then lay the ground upon the silvered side of a looking glass, and trace the outline of the picture or device thereon, through the silvering. I then remove the silvering within the said tracing, and apply the picture or device in the space thus formed, securing it by a suitable backboard, or otherwise. Or I place the said picture or device between a plain and silvered glass, which produces the same effect as the foregoing.

At other times I trace the outline, and remove the silvering, as in the last example, and then paint the desired picture or device upon the glass. In either of these modes of procedure a similar effect is produced.

What I claim as my invention is the forming a back ground of looking glass to pictures and ornaments of various kinds, upon the principle, and producing the effect herein described, whether the same be done by either of the modes hereinbefore mentioned, or in any other accomplishing the same object.

Isaiah Jennings.

On the Strength and Best Forms of Cast Iron Beams.

[Continued from p. 271.]

Experiment 11. Beam from model of experiment 9, the top and bottom ribs being altered: the areas of the top and bottom sections as one to four nearly. Strength 3214 lbs. per inch. This result compared with that to be given in experiment 13, for a beam of the common form, shows a gain of one fifth, nearly, in strength.

Experiment 12. Bottom flanch increased. Area of section of top and bottom one to five and a half nearly. Strength 3346 lbs., a gain of nearly one-fourth over the common form as given by experiment 13. If the weight of this beam be considered, it reduces the gain over the common form to one-seventh.

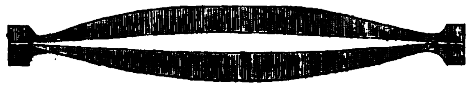
Experiment 13. Beam of the *common form*, cast from the same model as that of experiment 4. Strength 2693 lbs.

The form of the beams experimented upon was now entirely changed.

"The beams in our future experiments were of equal height, through their whole length, and had their top and bottom ribs uniform in thickness, but tapering toward the ends, the bottom rib being parabolic. They are represented by the subjoined vertical plan and elevation, where the sections at the middle of the several beams

are as in the following experiments; and the sections, from their middle toward the ends, as in experiments 11, 9, 3.

Plan.



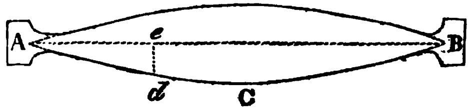
Elevation.

"This form was adopted to save metal, by reducing the bottom rib, which was likely to become very large. The reasonings by which I was led to suggest these deviations from the form of the elliptical beam before used, were the following:

"The vertical part, which was uniform through the whole length,* being thin comparatively with the bottom rib, the beam might be made of equal height throughout, and consequently its depth, and power of bearing near the ends, increased with little additional metal.

"From the form of fracture in the preceding experiments, and the great size which the bottom rib would be of, I was convinced that the neutral line in our future experiments would lie very low,† and, therefore, nearly all the tensile force would be exerted by the bottom rib, whilst the rest of the beam would serve for little more than a fulcrum; the centre of resistance to compression, or of that fulcrum laying very near to the top, it being perhaps at the point r‡ in our former experiments.

"Suppose D to be the vertical distance from the centre of compression, at any part of the beam, to the centre of tension in the bottom rib; and T to be the direct tensile strength of the bottom rib at that part; then T multiplied by some function of D, (perhaps $T \times D$) will represent the strength of the beam there. But D, throughout the same beam, will be a constant quantity, or nearly so; the strength of the beam, therefore, at any part, will be nearly in proportion to that of its bottom rib at that part; and as the strain will be less toward the ends, the bottom rib may be reduced there likewise.



"Suppose the bottom rib to be formed of two equal parabolas, the vertex of one of them ACB being at C; then by the nature of the

* The vertical part of the beam ought, like the ribs, to have been reduced toward the ends, considering the leverage only; but that was neglected as there might have been too great a tendency in the weight to cut the beam across, near to its ends, if it were more reduced there. See article 33, (page 265.)

† This was verified by the 19th experiment, where the wedge showed the neutral line to be at three-fourths of the depth.

‡ See cuts pages 268, 269, &c.

curve, $d\,e$ is as $A\,e \times B\,e$; the strength of the bottom rib, therefore, and consequently that of the beam at that place will be as this rectangle. It is shown, too, by writers on the strength of materials, that the rectangle $A\,e \times B\,e$ is the proportion of strength which a beam ought to have, to bear equally the same weight every where, or a weight laid uniformly over it; it would appear, therefore, that the beam above is rightly devised, and these views will be strengthened by the future experiments.

"The length of the parabola AB in the following experiments, was just four feet six inches, or equal to the distance between the supports, and three inches were added to each end of the beam beyond the points A and B, to lay upon the props; the parabolic bottom was likewise a little strengthened at the ends, as in the figure.

Experiment 14. Distance between the supports 4½ feet, and depth of beam 5⅛ inches. Strength 3246 lbs. Broken by tension, near the middle of the beam.

Experiment 15. Distance between the supports and depth of beam as before. Area of bottom rib increased from 2.314 inches to 2.916 inches. Strength 3194. Beam broken by tension.

Experiment 16. Beam from the same model, but with a larger bottom rib, viz. of 3.413 inches area. Strength less than preceding, from a defect probably in the material, the beam having broken at but little more than half the deflection at which that of experiment 15 gave way.

Experiment 17. Beam of the common form, as in experiment 4. Result not comparable, the same remarks applying as have been made upon experiment 16. Strength about 2466 lbs. per square inch.

Experiment 18. Beam of the same model as that used in experiment 16. Strength 3317 lbs. per square inch.

"43. The preceding beams were intended to be equally strong, in every part, to sustain a load laid uniformly over them; and to see if that was the case in this beam, I made the following experiment: The larger arm of the beam was placed on two supports, two feet three inches apart, and had 26497 lbs. laid upon its middle, without breaking there: it failed at its fractured end, or it would have been tried further.

"Now, from the principle of the lever, (see problem further on,) the strength of half of a beam so broken, is to the strength of the whole beam, as three to two.

"Hence, as the whole beam broke with 19441 lbs. the half should not have broke with less than 29161 lbs. We have no data to prove whether this would or would not have borne that weight, 26497 lbs. only having been laid on it; it is however probable that it would have borne it or a greater weight.

"Another half of a beam of nearly the same dimensions, and which must either have belonged to that in experiment 15 or 16, broke as before in its middle, with 22255 lbs. the breadth of the bottom rib, at the place of fracture, being 4.6 inches.

Now 2 : 3 : : 16905 (expt. 15) : 25357 lbs.
" 2 : 3 : : 14336 (expt. 16) : 21504 lbs.

"Hence, the strength of the end of the beam was a little in defect or excess, according as it belonged to the former or the latter of these experiments.

"The beams in the preceding four experiments, commencing with experiment 14, were cast together, and supposed to have been from the same iron, but the results were so anomalous that nothing could be learned as to the relative strength; there was, however, one fact proved by them, and that a very important one; every beam had broke by tension, or through the weakness of the bottom rib, which though so large had always been torn asunder, while the top part had remained unchanged. It having been prevented from twisting by the small rib there, showed no signs of being over compressed.

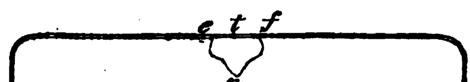
"44. In the following four experiments, and indeed in all the following ones, a good deal of attention was paid to the iron, it was the same as that used in the commencement of this series, and of which a description has been given: it is a strong iron, and was considered by Mr. Lillie as best adapted for beams."

Experiment 19. The last beam having still broken by tension, the bottom rib was again increased, by making it thicker, without altering the depth of the beam. Area of bottom rib 4.4 square inches.

"This beam broke in the middle by compression with 26084 lbs. or 11 tons 13 cwt., a wedge separating from its upper side.

"The weights were laid gradually and slowly on, and the beam had borne within a little of its breaking weight, a considerable time, perhaps half an hour.

"The form of the fracture and wedge is represented by the figure, showing a side view of the beam; where enf is the wedge, $ef = 5.1$ inches, $tn = 3.9$ inches, angle enf at vertex $= 82°$.



"It is extremely probable, from this fracture, that the neutral point was at n, the vertex of the wedge, and therefore at three-fourths of the depth of the beam, since 3.9 inches $= \frac{3}{4} \times 5\frac{1}{4}$ inches nearly.

"Hence strength per square inch of section $= \frac{26084}{6.4} = 4075$ lbs.

which is much greater than that in any of our former experiments.

"Comparing this result with that of the common beam in experiment 22nd, which was cast with these, and which bore 2885 lbs. per inch, we have $4075 - 2885 = 1190$ lbs. $=$ excess.

"$\therefore$ Gain in strength, from the section, $= \frac{1190}{2885} = .41$, or upwards of two-fifths of what was borne by the common beam.

"The quantity of metal saved, through the section, would be re-

presented by the above excess 1190, divided by 4075, the quantity which the beam bore per square inch of section.

"∴ *Saving of Metal,* from section, $= \frac{1190}{4075} = .292$, or $\frac{3}{10}$ nearly.

"If we compare the strength of this beam, and that in experiment 22, by the weights, as was done in experiments 11 and 12, we shall have the saving in metal, through the section and general form of the beam conjoined, $= .377$.

"As this is the strongest beam we have tried, if it be compared, by weight, with the result from the very strong beam, of the common form, in experiment 7, the saving in metal will be .29.

"45. Thus we have, by constantly making small additions to the bottom rib, arrived at a point where resistance to compression could be no longer sustained; but it was not till the bottom rib had considerably more matter in it than double the rest of the beam, the bottom rib being to the rest as 4.4 to 1.83, and to the top rib as 6 to 1. Still the top rib was not crushed, nor showed any signs of weakness. The fracture took place by the vertical part of the beam becoming torn, by the opposite forces of tension and compression round the neutral line, (see art. 33,*) as was the case in the experiment in article 23.†

"The great strength of this section is an indisputable refutation of that theory, which would make the top and bottom ribs of a cast iron beam equal."

Experiment 20. Same model as that used in experiment 19. The beam broke in the middle by tension with 23249 lbs.

"This is considerably less than what the former beam bore, through its bottom rib, in which the tensile power of this form of section almost wholly lies, was not much different. The iron must therefore have been weaker.

"Strength per square inch of section $= \frac{23249}{6.5} = 3576$ lbs.

"Comparing this with the result of the common beam in experiment 22, which bore 2885 lbs. per inch, $3576 - 2885 = 691 =$ excess.

"∴ Gain in strength, from section $= \frac{691}{2885} = .236$, in terms of what the common beam bore; whence saving in metal $= \frac{691}{3576} = \frac{1}{5}$ nearly.

"If we compare this beam with the common one, by their weights, the saving metal will be .26, or upwards of $\frac{1}{4}$th.

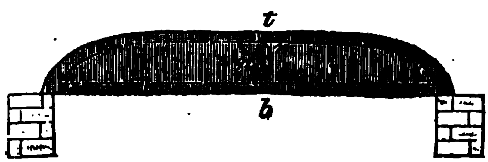
"The thickness of the vertical part of the beam, in experiment 19, was .266, and in this experiment .335; we might therefore have increased the bottom rib of this beam, in the ratio of 335 to 266, or $\frac{1}{3}$d nearly, when it is probable the beam would have broke equally soon by tension, or by the rupture of the vertical part as in experiment 19.

* Page 265. † Page 262.

And a much greater excess of strength than that above would have been obtained."

Experiment 21. The beam *elliptical*, being cast from the same model as that in experiment 12, but having the bottom rib increased: broke near the middle by tension with 21009 lbs.

"Form of fracture nearly as *b n r* in figure; *bn* = 1.8 inches.



"Hence strength per square inch of cross section $= \frac{21009}{5.41} = 3883$ pounds.

"Comparing this with the result from the common beam in experiment 22, which bore 2885 lbs. per inch $3883 - 2885 = 998 =$ excess.

"Hence gain in strength $= \frac{998}{2885} = .345$, in terms of what the common beam bore: or saving in metal, from section, $= \frac{998}{3883} = .257$, or upwards of $\frac{1}{4}$th.

"If the comparison be made by their weights, the saving in metal will be only .23, which is less than it would have been, had the ends of the beam been formed as in the preceding ones from experiment 13 to this: the bottom rib of this being all of a breadth and thickness, and five feet long; though the distance of the supports was but four feet six inches. This remark applies, though in a less degree, to the beams in expts. 11 and 12, and those immediately preceding them; those beams, like this, having their vertical part an ellipse, and their bottom rib of equal breadth throughout."

Experiment 22. Beam of the common form for comparison. Accident prevented the results from being of authority. The approximate strength is given at 2885 lbs.

The author next proceeds to comment upon the twenty-two experiments already made.

"46. It has been doubtless remarked that, in most of the foregoing experiments, the vertical part of the beam was made much thinner than the bottom rib; which it was necessary for it to be, otherwise that rib must have been proportionably broader, and this would have endangered the strength of it, by its liability to flexure. The injury from irregular cooling in metal of unequal thickness, I was in some degree acquainted with, and it was soon mentioned to me by Mr.

Ewart, whose extensive general knowledge and kindness left few maxims connected with the material uncommunicated. It was felt to be an objection: the appearance of the surface of fracture was minutely examined, but nothing was elicited from it: there was a difference in the aspect of the bottom rib and other parts, but only such as iron of different thickness unconnected would have shown. There was a powerful argument, too, in our favour; we had excellent castings; they had no flaws or defects in them which could be attributed to the cause mentioned above, and their progressively increasing strength left it, I conceive, without doubt, that irregular cooling had no mischievous effect on beams cast like ours. The reason of it may possibly be this, the beam being mostly cast erect, and wrong side up, the heavy bottom rib, lying near the surface in the sand, might nearly keep pace in cooling with the thinner part lower down; and in those cases where the beam was cast on its side, it would cool more regularly with the sand in which it was buried.

"47. In the preceding experiments, it has been mentioned, that we began with that form of section which a highly ingenious modern writer on the strength of cast iron was induced to consider as the strongest to preserve its elasticity, the top and bottom ribs in it being equal; and this form we found to be $\frac{1}{12}$th weaker to resist an ultimate strain, than that of the common beam in the iron on which he wrote, though it would, as we have before seen, be perhaps the strongest in wrought iron. We then, by gradually reducing the top rib in the same model, and adding the part taken off to the bottom one, obtained castings in which the strength was found to be regularly increasing, and the form, in experiment 3d, somewhat stronger than that of the common beam. It did not now seem adviseable to decrease further the top rib; and as every beam had been found to break by tension, or through the weakness of the bottom part, I thought it best to keep increasing the bottom rib by small degrees until the beam broke by the rupture of some other part. This increase was commenced in experiment 9, the ribs in that being as $4\frac{1}{2}$ to 1; and the result, from the form of section, in this case was a gain in strength of about $\frac{1}{7}$th: this beam also broke by tension. Now before increasing the bottom rib any further, I thought it adviseable to add a little to the top one, as the vertical part of the beam, or that part between the ribs would be, perhaps, strong enough for much larger ribs. In expts. 11, 12, and 21, the top rib and vertical part of the model were the same, the only difference being in the breadth of the bottom rib: from the first of these the increase of strength in terms of what was borne by the common beam was $\frac{1}{5}$th, from the second $\frac{1}{4}$th, and from the third $\frac{1}{3}$d; and had we added still more to the bottom rib in the same model, it is probable that the gain might have been much greater.

"48. In experiments 14, 15, 16, 18, 19, and 20, the top rib of the model was the same, but somewhat larger than in experiments 11, 12, and 21, and the bottom rib was the only one varying. In the 19th experiment the section of the bottom rib at the place of fracture was more than double the rest of the section, and the ratio of

top and bottom ribs was 1 to 6. In this instance the fracture took place by the rupture of the vertical part of the beam, which happened to be thinner than usual; the gain in strength here, from the section, was upwards of $\frac{2}{5}$ of what the common beam bore; and the saving by it was nearly $\frac{3}{10}$ of the metal. This experiment was repeated in expt. 20, but the beam seems to have been of somewhat weaker iron.

"49. The form of section, in experiment 19, is the best which we have arrived at for the beam to bear an ultimate strain. That in experiment 21, if its bottom rib had been a little further increased, would, it is probable, have borne nearly as much per square inch of section, but its narrower top rib, when tapering towards the ends as in our latter beams, might probably have allowed the beams to have twisted there; a tendency which was observed in an experiment further on. If, then, we adopt the form of beam in experiment 19, I think we may confidently expect to obtain the same strength with a saving of upwards of $\frac{1}{4}$th of the metal; or in other words, that 75 tons of metal will bear more than 100 tons would, if cast in the best models of the usual form.

"50. In the first seven of the preceding experiments those deflections which were obtained were taken in the middle of the beam, but from the mode then used, not with great accuracy. In the succeeding ones a good deal of care was taken, and I imagine they are not very incorrect, though, on account of the smallness of the deflections, inaccuracies could scarcely be avoided; they were not in these taken in the middle of the beam, but three inches from it, as it was more convenient to take them there than in the middle.

"51. If we examine the deflections in experiments 18, 20, and 21, we shall find that in the first and third about two-thirds, and in the second upwards of one-half the breaking weight was laid on without the elasticity being in appearance at all injured. Now this is contrary to former experience, it having been generally found that the elastic force was sensibly injured with about one-third of the breaking weight, (Tredgold's Essay, p. 79.) And as experiments have mostly been made upon rectangular pieces, the above fact, if properly ascertained, will render it probable that change of form may have an influence upon this ratio; and may, in some forms, remove the point of incipient derangement from one-third to one-half, or even two-thirds of the breaking weight.

"52. In the preceding experiments the beams being short, and the deflections small, there was considerable difficulty in ascertaining the precise point where the above defect took place; but the matter seemed to be too important to be allowed to pass without some further investigation, and especially as we should be enabled at the same time to determine what influence a change in the depth of one of our beams would have upon its strength, every other dimension remaining the same. For these purposes, therefore, I made the following experiments.

"In these, and indeed in all the future experiments, the same sort

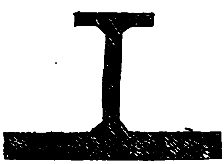
of beam was used as that in our last, and which was described immediately before experiment 14; it was broken too in the same manner. There was, however, this slight difference, that there the parabolic base was but just equal in length to the distance between the supports, and the beam had its ends rendered a little wider and longer with matter attached to them to lie on the props; but here the parabola was made six inches longer than the distance between the props, in order that three inches of it might lie upon them at each end; this was done to render the beam capable of bearing more towards the ends, as there was some doubt whether in the preceding experiments the ends were not a little too weak. The beams were all cast seven feet six inches long, and were supported by props seven feet asunder; they were from the same model, which varied only in the breadth of its vertical part, the depth of the beam being all that was intended to vary. The depths were nearly four, five, six, and seven inches; but accurate admeasurements are given with the sections.

"The vertical part in the beams was rendered too strong comparatively with the size of the bottom rib; it was desirable it should be so, that they might all break by tension, or in the same manner, to furnish the means of judging correctly of their relative strength. The bottom rib ought otherwise to have been made stronger, or the vertical part thinner."

Experiment 23d being the first of a new series, we extract the details.

XXIII. EXPERIMENT.

"Distance between supports seven feet, depth of beam 4.1 inches.



Dimensions of section at place of fracture, or middle.

Area of top rib = 2.25 × .33 = .74 in.
,, bottom ,, = 6.00 × .74 = 4.44 ,,
Thickness of vertical part = .40 inches.
Area of section = 6.54 inches.

Weight of casting = 1 cwt. 0 qrs. 2 lbs. = 114 lbs.

Weight in lbs.	Deflections in parts of an inch.	Returned to (weights removed.)
2764	.25	0
2879	.25	0
2994	.26	0
3109	.26	0
3224	.27	0 doubtful.
3339	.28	0
3454		perceptible set.
3569	.29	,,
3684	.31	.04
3914	.32	.05
4029	.32	.05

"The beam was now removed, and having been again placed under the lever, the experiments were recommenced, and the deflections taken from the form it had assumed.

Weights.	Deflections.	Returned to.
5180	.40	0
5353	.41	0
5525	.44	0
5698	.44	0
6042	.45	0
6215	.51	0
6971	.55	apparent set.
7349	.57	
7727	.62	
8105	.64	
8483	.70	
8861	.74	

"The beam not having been broke at this time, the experiment was resumed two days afterwards, when the beam seemed nearly straight again, and the deflections were those from the form it then had acquired.

Weights.	Deflections.	Returned to.
8637	.75	.03
9327	.76	.03
10017	.80	.03
10707	.88	.03
11397	.95	.04
12087	1.04	.08
12815	1.08	.09

13543 It broke with this within 1½ inches of the middle by tension: 13543 lbs. = 6 tons, 103 lbs.

"53. For a beam to support equally through its whole length a uniform load, it is necessary that it should bear the same weight, when applied towards its ends, that it bore in the middle. To ascertain whether the above beam would have done this, the longer half of it was placed upon two supports three feet six inches asunder; one prop supporting the end as before, and the other lying under the middle of the beam. Weights were then gradually laid on, half way between the supports, till fracture took place. It broke with 23396 lbs. or 10 tons 8¾ cwt., 15 inches from the end, and where the breadth of the bottom rib was 3.85 inches. Now, by the property of the lever, the pressure, which the whole beam bore, is, to the weight which the half beam broken as above, should have borne, as two to three. Hence 2 : 3 : : 13543 lbs.: (weight borne by whole beam:) 20314 lbs. = weight which the half beam should have borne: but it required 23396 lbs. to break it; hence a parabolic beam similar to that above, seven feet six inches long, and broken by props seven feet asunder, is rather too strong toward the ends; and it would have been too strong there still, if the props had been seven feet six inches distant, or at the ends of the parabolic base of the beam.

"54. The other half of the beam was turned the wrong way up, and broken by weights gradually laid on its middle, or half way between the props, one prop supporting the end of the beam as before, and the other placed three feet three inches from it. It broke in the middle with 13356 lbs. or 5 tons 19¼ cwt.

"If we reduce this weight to what it would have been if the distance of the props had been three feet six inches as above, we have three feet six inches: 3 feet 3 inches, or 14 : 13 : : 13356 :12402 lbs. or 5 tons, 10¾ cwt. which is little more than one-half of what the former half beam bore; and the difference of strength would have been much greater, if we had used two equal whole beams. Hence we see the impropriety of turning beams the wrong side up, as is often done in factories. But this matter was still more clearly shown in one of our early experiments (art. 23,) where a T section of cast iron bore nearly four times as much one way up as the other."

Experiment 24. Distance between the supports seven feet, depth of the beam 5.2 inches. Area of top rib .79 sq. inch, of the bottom rib 4.62 sq. inches. Weight of casting 128 lbs. Broke by tension near the middle, with a weight of 15129 lbs. Strength per square inch 2180 lbs. The relative strength of this beam supposing it four feet six inches long, would have been 3391 lbs. per square inch, the material was therefore weaker than that forming the beams of experiments 19, 20 and 21.

Experiment 25. Distance between the supports as before. Depth of beam six inches. Areas of top and bottom rib very nearly as in experiment 23. Weight of casting 127½ lbs. Broke by tension near the middle with 15129 lbs. The author supposes this beam to have been rendered weak by a twist in the vertical part of the casting. The elasticity was nearly destroyed by a weight of 12087 lbs.

Experiment 26. Depth of beam 6.93 inches. Areas of top and bottom ribs nearly as before. Weight of casting 146 lbs. Elasticity nearly destroyed by 13543 lbs. Beam broken by tension exactly in the middle, by a weight of 22185 lbs.

Experiment 27. Depth of beam 6.98 inches. From the same model as the last. Weight of beam 141 lbs. A weight of 19049 lbs. produced a deflection of .58 of an inch.

"With this last weight the beam was conceived to be very near fracture; the weights were therefore removed, and the casting was found to have taken a set of one-tenth of an inch.

"56. To ascertain whether the beam was as strong towards the ends as in the middle to bear a uniform load, weights were now gradually laid upon the beam, at a point half way between the middle and the end, in the same manner as in the note after experiment 24. It bore 20225 lbs. for about half a minute, and then broke near the end, at a place in the under side of the bottom rib, where it was rather unsound. The inference from this experiment, though imperfect, is that the beam would bear a somewhat greater weight near the ends than in the middle.

"57. From these experiments it appears that the ultimate strength in sections like the preceding, is, cæteris paribus, nearly as the depth; but somewhat lower than in that ratio.

"With regard to the elasticity there are some anomalies; experiments 25 and 26 exhibited no defect, when the first beam had borne upwards of two-thirds, and the latter more than one-half the breaking weight. But experiment 23, which was on a beam of very small depth, shows a deviation at an early period; it was, however, very small till upwards of half the breaking weight was laid on; when perhaps the elasticity of the bottom rib began to be injured. The former defect being attributable to some inconsiderable falling off in the elasticity of the compressed part of the beam; possibly arising from oblique compression, through greater flexure in a shallow beam.

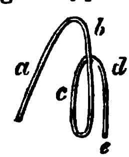
"58. There seems, therefore, to be little doubt that the elastic force is longer perfect in these forms than in those on which experiments have generally been made, and the reason may probably be this: the earlier deflections in our best beams are almost wholly caused by compression, on account of the smallness of the compressed part; and it appears highly probable that cast iron would remain perfectly elastic under much greater forces when applied directly to compress it, than would be required to injure its elasticity by tension."

[TO BE CONTINUED.]

TRANSLATIONS FROM THE FRENCH JOURNALS.*

Chemical Instruments.

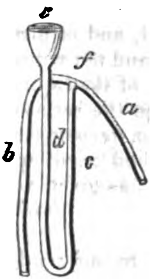
At the session of the Society for the Encouragement of National Industry, November 29th, M. Collardeau presented two syphons of a new and ingenious construction. They are applicable to cases in which liquids of a corrosive nature, or at a high temperature, are to be transferred from one vessel to another. The first is a common glass syphon of which one of the branches is bent twice so as to return upon itself, (See annexed cut.) One extremity



e terminates in a capillary tube. The syphon is made to fill itself by placing the finger upon the opening *e* and plunging the branch *a*, up to the curved part, in the liquid. The finger removed, the liquid passes the curved part of the branch *a*, descends through *b*, and rising again flows into the branch *d*, issuing through the opening *e*. When the transfer of the liquid is completed, and the syphon removed, two columns of liquid of equal height remain in the branches *b* and *c*, and to set the syphon again in operation it is only necessary to plunge the branch *a* in the liquid. It is unnecessary to enter into the explanation of the mechanical laws which produce the action just described. We pass rather to a description of the second

* Made at the request of the Committee on Publications.

syphon which will be more generally useful in the arts than the one just described. This is a common syphon, of which the two branches

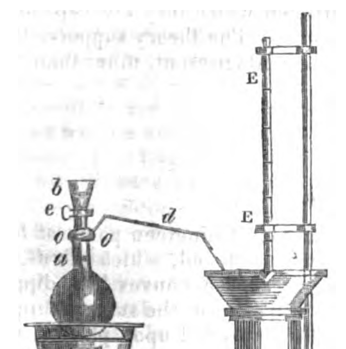


a and *b* are shown in the annexed cut. To this syphon is joined a tube bent into the form of the letter U. One of the branches, *d*, rises higher than the bend of the syphon, and is terminated by a receptacle, *e*; the other branch, *c*, joins the syphon at *f*. To put this syphon in action, a small quantity of the liquid to be transferred is put into the receptacle *e*. This liquid fills the tube *d*, rises into *c*, and passes into the branch *a*; the branch *b* being dipped into the liquid to be decanted it rises in *b*. By pouring more liquid into *e*, causing a flow through *a*, the liquid is drawn into the bend joining *b* and *a*, and the syphon is filled.

[*Bulletin de la Société d'Encouragement, &c.*

New method of testing the Strength of Bleaching Powders.

The important object of a test for the strength of bleaching powders has given rise to many ingenious methods, of more or less easy execution. The following is proposed by MM. Henry, Jr. and A. Plisson. It is founded upon the property which chlorine has, whether free or combined with oxides, of reacting, by the aid of heat, upon certain salts of ammonia, or upon a solution of ammonia in water. The product of this reaction will be nitrogen gas in a proportion to the chlorine which may be calculated by theory.



The apparatus consists of a glass flask of the capacity of about half a pint. Into the neck of the flask a glass funnel *b* is cemented, having a stop cock *e*, and through a second opening in the neck a bent tube *o d* is passed. This serves to conduct the gas disengaged in the flask into a tube E E where the measurement is made. To apply the apparatus, the solution of chlorine, or of the chloride, in a known quantity of water, is placed in the flask, which is then tightly corked and the tube *o d* inserted. Next a solution of some ammoniacal salt, as the sulphate, the carbonate, or bi-phosphate of ammonia is added: this last mentioned salt, or a solution of ammonia, is to be preferred to the other compounds mentioned. Heat is gradually applied, and the gas carefully collected over water which should be ren-

dered slightly alkaline when carbonic acid may be one of the products of the reaction. When the operation is concluded, the flask is filled with water to drive out all the gas. The gaseous product consists of the atmospheric air which the apparatus contained, and of nitrogen from the decomposed ammonia. Knowing beforehand the volume of air which the flask contained after the introduction of the liquids, and subtracting it from the bulk of the gas collected in the receiver, the quantity of nitrogen corresponding to the ammonia decomposed, that is to the chlorine present, is found. This method tried upon liquids of which the composition was exactly known has given very satisfactory results. [*Ibid.*

Note by Translator.—It may not be amiss to state to our readers the theory of the above process. Ammonia is composed of nitrogen and hydrogen, in the ratio of three parts by bulk of hydrogen to one part by bulk of nitrogen. Chlorine unites with hydrogen to form muriatic acid; the chlorine in muriatic acid being to the hydrogen in the ratio of one part by bulk of chlorine, to one part by bulk of hydrogen. If a solution of chlorine react upon a solution of ammonia, for every three parts by bulk of chlorine which unite with hydrogen, one part by bulk of nitrogen gas is liberated. Every part, say cubic inch, of nitrogen which is collected in the process just described, corresponds to three parts, cubic inches, of chlorine in the solution of chlorine or of the chloride: deduction having been made for the atmospheric air introduced from the flask. If we would know the proportion of chlorine by weight in a given weight of the chloride, it is readily found from the ascertained bulk. One hundred cubic inches of chlorine gas when the thermometer is at 60° Fah. and barometer at 30 inches, weigh 76.25 grains. The relative values of different bleaching powders will be given by the relative bulks of nitrogen which they are capable of disengaging from a solution of ammonia. The theory supposes that no reaction takes place between the elements present, other than that just described.

Mirrors of Fusible Alloy.

Berzelius has found that by the union of nineteen parts of lead and twenty-nine of tin, a fusible alloy is produced, which affords, on cooling in thin plates, very bright surfaces. A convex lens dipped several times into the melted alloy, yielded from the surface dipped a concave mirror of great lustre. This, mounted upon plaster, was preserved for some time in the air untarnished. Dust destroys these mirrors, which will not bear wiping.

[*Ibid, or Berzelius, Traité de Chimie, vol. iii.*

¶ *On the Employment of Heated Air in the Smelting of Iron.**

Among the many discoveries that have of late been made in chemical science, there are perhaps few of more practical importance than the ingenious application of heated air in the smelting of iron ore, either in the immediate benefit which it will confer on this important art, or in the various improvements which it is likely to lead to in other operations. The following is a very brief outline of the manner in which the heated air is applied in some of the iron works where this method of working the ore has been introduced.

The air is blown by cylinder bellows in the usual manner, but before entering the smelting furnace it passes through pipes of cast iron heated to redness, which are altogether about thirty feet in length, and three feet in diameter. They are usually made in three or four pieces, joined together by apertures considerably less than three feet in diameter, and placed horizontally, or in whatever manner the local arrangements about the furnace may render most convenient. A brick arch is then thrown round the pipes, leaving a free space of about eight inches and upwards between it and them, and two or more furnaces constructed so as to heat the pipes in the archway, the flues playing into it, and terminating in a common vent at the farther extremity. They may be considered, therefore, as placed on the floor of a long and reverberatory furnace, about six feet high, and nearly of the same breadth, being at the same time protected by fire bricks where they might be injured by the direct flame of the furnaces.

The iron ore is smelted according to this plan with little more than half the coal necessary when the furnaces are worked with air in the usual manner; the small coal which is sold at an inferior price is found quite sufficient for heating the pipes.

It has also been ascertained, that there is no difficulty in smelting the iron ore with common coal instead of coke, and in some furnaces at present in use, no coke whatever is employed, so that it is probable the trouble and expense attending its preparation will be unnecessary. It is likewise in contemplation to endeavour to reduce the iron ore at once in the furnace, without any previous calcination, and the proprietors of some of the iron works seem to entertain little doubt that they will be successful in the attempt.

The great effect produced by the heated air in these furnaces must be attributed to the circumstance that, according to this plan, a higher temperature can be more easily excited and maintained, than when the blast is supplied with air at the ordinary temperature of the atmosphere. And the great saving of fuel we would presume, does not arise from a greater *quantity* of heat being evolved from a given quantity of coke, or coal, in the one case than in the other, but from the greater *intensity* of temperature that prevails when the heated air is

* Articles selected by the Committee of Publication will in future be designated by this mark, ¶.

employed, insuring the more steady and certain action of the charcoal on the calcined iron-stone, less or none being exhausted without any adequate return, i. e. consumed at an inferior temperature, without affecting the ore in contact with it. It is possible, however, that the absolute quantity of heat evolved may differ according to the temperature at which an inflammable substance is consumed, though no precise experiments have been made to determine this.

If we consider the quantity of air required for the combustion of common inflammable matter, we shall be better able to appreciate the important effects which must arise from the use of heated air. Let us suppose that coke alone is used in the smelting furnace, and that carbonic oxide is the sole product of the combustion in that part of the furnace where the blast takes effect upon the fuel, then, even according to this calculation, every six parts by weight of charcoal require no less than thirty-six of atmospheric air for their combustion, this quantity containing only eight parts of oxygen. Accordingly, though the air may be so thin and attenuated that we are apt to overlook its cooling influence, every portion of combustible matter mixes with six times its weight of cold air, (air at natural temperatures,) all of which must be heated to a certain extent at the expense of the fuel already in a state of combustion, before it can give out any heat by its action on the inflammable matter of the coal. If, again, carbonic acid be the product of the combustion when the heat is more powerful, twice as much air, (seventy-two parts,) will be necessary for every six of charcoal, or each portion will require twelve times its weight of air. The first effect of the introduction of this large quantity of cold air, must be to diminish the actual temperature of the furnace, however much it may add to it immediately afterwards as it is consumed. If, then, the air be heated before it passes to the furnace, its temperature must be higher than when air is supplied in the usual manner, just in proportion to the degree of heat previously communicated to it.

The high temperature of the furnace not only enables the iron ore to be melted with less fuel than would otherwise be necessary, but by effecting a complete separation of the scoriæ from the melted iron, may contribute also to produce a purer and more perfect pig iron; as it is possible, however, that under these circumstances the iron may receive a larger impregnation of the bases of the earths which are decomposed in small quantity during this operation, the quality of the product demands the most careful examination. The specimens we happened to see, so far as we could judge from bare inspection, appeared excellent.

[*Edinburgh New Philos. Jour. for January*, 1832.

Steam Carriages.

The Committee of the House of Commons, appointed to examine the practicability of employing steam carriages on ordinary roads,

having issued their report, we have much pleasure in presenting our readers with an extract of such parts as appear to possess a character of importance, and to throw light upon this interesting subject.

"The committee proceeded in the first instance to inquire how far the science of propelling carriages on common roads, by means of steam or mechanical power, had been carried into practical operation; and whether the result of the experiments already made had been sufficiently favourable to justify their recommending to the house, that protection should be extended to this mode of conveyance, should the tolls imposed on Steam carriages, by local acts of parliament, be found prohibitory or excessive.

"In the progress of their inquiry, they have extended their examination to the following points on which the chief objections to this application of steam have been founded; viz. the insecurity of carriages so propelled, from the chance of explosion of the boiler, and the annoyance caused to travellers, on public roads, by the peculiar noise of the machinery, and by the escape of smoke and waste steam, which were supposed to be inseparable accompaniments.

"It being also in charge to the committee, 'to report upon the proportion of tolls which should be imposed upon steam carriages,' they have examined several proprietors of those already in use, as to the effect produced on the surface of roads by the action of the propelling wheels.

"As this was too important a branch of their inquiry to rest entirely on the evidence of individuals whose personal interest might have biassed their opinions, the committee also examined several very scientific engineers, by whose observations on the causes of the ordinary wear of roads they have been greatly assisted.

"The committee were directed also to report 'on the probable utility which the public might derive from the use of steam carriages.' On this point they have examined a member of the committee, well known for his intelligence and research on subjects connected with the interests of society, and they feel that they cannot fulfil this part of their instructions better than by merely referring the house to the evidence of Colonel Torrens.*

"These inquiries have led the committee to believe that the substitution of inanimate for animal power, in draught on common roads,

* He says, "I conceive that agriculture is prosperous in proportion as the quantity of produce brought to market exceeds the quantity expended in bringing it there. If steam carriages be employed instead of carriages drawn by horses, it will be because that mode of conveyance is found the cheapest. Cheapening the carriage of the produce of the soil must necessarily diminish the quantity of produce expended in bringing a given quantity to market, and will therefore increase the net surplus, which net surplus constitutes the encouragement to agriculture. For example, if it requires the expenditure of two hundred quarters of corn to raise four hundred, and the expenditure of one hundred more on carriage, to bring the four hundred to market, then the net surplus will be one hundred.

"If, by the substitution of steam carriages, you can bring the same quantity to market, with an expenditure of fifty quarters, then your net surplus is increased from one hundred to one hundred and fifty quarters: and consequently

is one of the most important improvements in the means of internal communication ever introduced. Its practicability they consider to have been fully established; its general adoption will take place more or less rapidly, in proportion as the attention of scientific men shall be drawn by public encouragement to further improvement.

either the farmer's profit, or the landlord's rent increased in a corresponding proportion. There are many tracts of land which cannot be cultivated, because the quantity of produce expended in cultivation and in carriage exceeds the quantity which that expenditure would bring to market. But if you diminish the quantity expended in bringing a given quantity to market, then you may obtain a net surplus produced from such inferior soils, and consequently allow cultivation to be extended over tracts which could not otherwise be tilled.

"On the same principle, lowering the expense of carriage, would enable you to apply additional quantities of labour and capital to all the soils already under cultivation. But it is not necessary to go into any illustrative examples to explain this, it being a well known principle, that every improvement which allows us to cultivate land of a quality which could not previously be cultivated, also enables us to cultivate, in a higher manner, lands already under tillage.

"If steam carriages were very suddenly brought into use, and horses thereby displaced, I think the effect stated in the question would be produced for a time; but practically, steam carriages can be introduced only very gradually, and the beneficial effect upon the profits of trade, by bringing agricultural produce more cheaply to market, will tend to increase profits, to encourage industry, and to enlarge the demand for labour; so that, by this gradual process, there will probably be no period during which any land can actually be thrown out of cultivation, the increasing population requiring all the food which horses would cease to consume.

"With respect to the demand for labour, that demand consists of the quantity of food and raw materials which can be cheaply obtained: and as, by the supposition, the displacing of horses will leave at liberty more food and more material, the demand for labour will ultimately be greatly increased instead of being diminished. It has been supposed, I know not how accurately, that there are employed on the common roads in Great Britain, one million of horses, and a horse, it is calculated, consumes the food of eight men. If steam carriages could ultimately be brought to such perfection as entirely to supersede draught horses on the common roads, there would be food and demand for eight millions of persons. But when we take further into consideration, that lowering the expense of carriage would enable us to extend cultivation over soils which cannot now be profitably tilled, and would have the further effect of enabling us to apply, with a profit, additional portions of labour and capital to the soil already under tillage, I think it not unfair to conclude, that were elementary power on the common roads completely to supersede draught horses, the population, wealth, and power of Great Britain, would at least be doubled.

"If there are soils of such a peculiar quality that oats is the only marketable product which they will yield, the persons employed in cultivating those lands would certainly be thrown out of that particular occupation; but the extension of tillage over other lands, not of this peculiar quality, would create a demand for labour, which would much more than absorb the persons thrown out from the culture of oats upon that land which would grow nothing else. But I doubt of there being any land which it is profitable to cultivate, which would not raise some other agricultural produce than oats, either for man or cattle, for which the increasing population would create a demand.

"Upon the case supposed, namely, that steam carriages should be employed in conveying passengers only, and the whole change to be effected in a sudden manner, I think that there would, in the first instance, be a diminished demand for agricultural produce, but the following process would take place. As the demand for agricultural produce was diminished, the price of such produce

"Tolls, to an amount which would utterly prohibit the introduction of steam carriages, have been imposed on some roads; on others, the trustees have adopted modes of apportioning the charge, which would be found, if not absolutely prohibitory, at least to place such carriages in a very unfair position as compared with ordinary coaches.

"Two causes may be assigned for the imposition of such excessive

would fall, food would become cheaper, and the cheapening of food would benefit partly the labouring class, and partly the capitalists, the one obtaining higher real wages, and the other higher profits; this increase in real wages, and in profits, would effect a great encouragement to manufacturing industry, and would necessarily lead to an increase in the manufacturing population, and to the amount of capital employed in manufactures. The consequence would be, that after some degree of pressure upon agriculture, the increased number of human beings would create the same demand for agricultural produce which the employment of horses formerly created.

"So that even upon the extreme and most improbable supposition, that steam carriages should never be employed in conveying agricultural produce to market at a cheaper rate, still the benefit to the country would be very great, inasmuch as we should have a vastly increased industrious population, and England would become, much more extensively than she is at present, the great workshop of the world. In point of fact, superseding horses by mechanical power, would have precisely the same effect in increasing the population and wealth of England, as would be produced were we to increase the extent of the country by adding thereto a new and fertile territory, equal in extent to all the land which now breeds and feeds all the horses employed upon common roads. Such addition to the extent of fertile territory in England, suddenly effected, would, in the first instance, lower the value of agricultural produce, and be injurious to the proprietors of the old portion of the territory, but no person would therefore contend that if we could enlarge the island of Great Britain by additional tracts of fertile land, the public interests would be injured by such enlargement; this would be monstrously absurd. It is not less absurd to object to the increase of food available for human beings, by substituting mechanical power for horses.

"On the principles that have been already stated with respect to agriculture, the cost of bringing all things to market is comprised of the cost of production and the cost of carriage. Reducing the cost of carriage is precisely the same thing in its effects as reducing the immediate costs of production, consequently the conveyance of light goods by steam power, must cheapen all such goods to the consumers. This will necessarily enable them to consume a greater quantity of such goods, and the consumption of the greater quantity will enlarge the demand for labour, call a larger manufacturing population into existence, and thereby re-act on agriculture by increasing the demand for food.

"This cheaper mode of internal carriage will not only lower the price of light and refined manufactures to the home consumer, but will lower their price also to the foreign consumer. This will increase the advantages which we at present possess in the foreign market, and tend to increase our foreign commerce. So that here again there will be an increased demand for manufactures and for a manufacturing population, and here again will be another beneficial re-action upon the soil. So that the more we contemplate the various effects produced upon the industry of the country by a cheaper mode of conveyance, the more we must be convinced that wealth and population will be increased, and that agriculture, instead of being injured, must necessarily partake in the increased prosperity of the country. In addition to what I have already stated, the saving of expense and of time in conveying passengers and goods, and the rapidity of communication, will produce effects, the amount of which it would be almost impossible to calculate."

tolls upon steam carriages. The first, a determination on the part of the trustees, to obstruct, as much as possible, the use of steam as a propelling power; the second, and probably the more frequent, has been a misapprehension of their weight and effect on roads. Either cause appears to the committee a sufficient justification for their recommending to the house that legislative protection should be extended to steam carriages with the least possible delay.

"It appears from the evidence, that the first extensive trial of steam, as an agent in draught on common roads, was that by Mr. Gurney, in 1829, who travelled from London to Bath, and back, in his steam carriage. He states, that although a part of the machinery which brings both the propelling wheels into action, when the full power of the engine is required, was broken at the onset, yet that on his return he performed the last eighty-four miles, from Melksham to Cranford Bridge, in ten hours, including stoppages. Mr. Gurney has given to the committee very full details of the form and power of his engine, which will be found in the evidence.

"When we consider that these trials have been made under the most unfavourable circumstances—at great expense—in total uncertainty—without any of those guides which experience has given to other branches of engineering; that those engaged in making them are persons looking solely to their own interest, and not theorists attempting the perfection of ingenious models; when we find them convinced, after long experience, that they are introducing such a mode of conveyance as shall tempt the public, by its superior advantages, from the use of the admirable lines of coaches which have been generally established; it surely cannot be contended, that the introduction of steam carriages on common roads is, as yet, an uncertain experiment, unworthy of legislative attention.

"The several witnesses have estimated the probable saving of expense to the public, from the substitution of steam power for that of horses, at from one-half to two-thirds.

"Perhaps one of the principal advantages resulting from the use of steam, will be, that it may be employed as cheaply at a quick as at a slow rate; 'this is one of the advantages over horse labour which becomes more and more expensive as the speed is increased. There is every reason to expect that in the end the rate of travelling by steam will be much quicker than the utmost speed of travelling by horses; in short, the safety to travellers will become the limit of speed.' In horse draught the opposite result takes place; 'in all cases horses lose power of draught in a much greater proportion than they gain speed, and hence the work they do becomes more expensive as they go quicker.' On this, and other points referred to in the report, the committee have great pleasure in drawing the attention of the house to the valuable evidence of Mr. Davies Gilbert.*

* Mr. Gilbert says:—"I have made some further remarks, which I would beg to deliver in also, tending to point out particularly the advantage of steam conveyance when the rate of travelling is great: I would beg to add, that it appears to me extremely difficult to lay down any general rule which would be

"Without increase of cost then, we shall obtain a power which will insure a rapidity of internal communication far beyond the utmost speed of horses in draught; and although the performance of these carriages may not have hitherto attained this point, when once it has been established that at equal speed we can use steam more cheaply in draught than horses, we may fairly anticipate that every day's increased experience in the management of the engines will induce greater skill, greater confidence, and greater speed.

"Nor are the advantages of steam power confined to the greater velocity attained, or to its greater cheapness than horse draught. In the latter, danger is increased in as large a proportion as expense,

applicable to all situations and all roads, inasmuch as they vary with the nature of the materials: that up to a certain weight, proportionate to the corresponding width of the wheel, it is probable that the injury to any road may be very little, but that beyond a certain weight, compared again with a corresponding breadth of the wheels, the materials would be entirely crushed and the road totally destroyed; therefore it follows, that even on all roads there must be a limit to the weight of carriages, as it is quite impossible that a wheel of enormous breadth could bear uniformly on all its surface. For instance, where trains of artillery are drawn over roads, the excess of their weight, beyond what the materials are capable of sustaining, has been found sufficient for grinding them to powder. The slow conveyance of heavy weights may perhaps be affected by steam on well made and nearly level roads, so as to supersede the use of horses; but steam power is eminently useful for producing great velocities. It was last year determined by the Society of Civil Engineers, after much inquiry and discussion, that the expense of conveying carriages drawn by horses was at its minimum when the rate equalled about three miles an hour, and that expense of travelling increased up to the practical limit of speed, nearly as the velocity; including the greater price of horses adapted to swift driving, their increased feed and attendance, the reduced length of their stages, and with every precaution, the short period of their services; on the contrary, friction being a given quantity as well as the force requisite for impelling a given weight up a given ascent, the power required for moving steam carriages on a rail-way remains theoretically independent of its speed, and practically increases but a very little, in consequence of resistances from the atmosphere, slight impacts against the wheels, inertia of the reciprocating piston, &c. The expenditure of what I have termed efficiency, is as the actual force multiplied by the velocity, and the consumption of fuel in a given time will be in the same proportion, but the time of performing a given distance being inversely as the velocity, the expenditure of fuel will theoretically be constant for a given distance, and very nearly so in practice. The power requisite for moving bodies through water is the opposite extreme; here, the mechanical resistance of the fluid increases with the square of the velocity, as do the elevation of the water at the prow and its depression at the stern. The oars, or paddles, must therefore preserve a constant ratio to the velocity of the vessel; and the force applied will consequently vary as the squares of the velocity; and the expenditure of efficiency being as the force multiplied by the velocity, the consumption of fuel will be as the cube of the velocity in a given time, or as the square of the velocity on a given space; and I have ascertained from the records of voyages performed by steam vessels, that the law is nearly correct in practice: hence the great power required for such steam vessels as are constructed not merely for speed, but also to set at defiance the opposition of winds and seas; while, on the contrary, a very small power will be found sufficient for moving ships of the largest dimensions through the water, at the rate of two or three miles an hour, when their sails are rendered useless by continued calms.

by greater speed. In steam power, on the contrary, 'there is no danger of being run away with, and that of being overturned is greatly diminished. It is difficult to control four such horses as can draw a heavy carriage ten miles per hour, in case they are frightened, or choose to run away; and for quick travelling they must be kept in that state of courage, that they are always inclined for running away, particularly down hills, and at sharp turns of the road. In steam, however, there is little corresponding danger, being perfectly controllable, and capable of exerting its power in reverse in going down hills.' Every witness examined has given the fullest and most satisfactory evidence of the perfect control which the conductor has over the movement of the carriage. With the slightest exertion it can be stopped or turned, under circumstances where horses would be totally unmanageable. [*Lond. Jour.*

Remarks on the Explosion of Steam Boilers. Submitted by Mr. Jacob Perkins, *Civil Engineer, to the Select Committee of the House of Commons on Steam Navigation.**

A vast number of contrivances have been resorted to, to remove the great evil of steam boilers exploding. When the safety valve was invented, it was supposed that this desideratum was accomplished, as nothing theoretically appeared more certain. It was believed that all that then remained wanting was a boiler stronger than the power required to work the steam engine, after which all would be safe, if the safety valve should be kept in order. Time and practice have disappointed these sanguine hopes. That the safety valve cannot be depended on, as a security against explosions, is but too true; in fact, strange as it may appear, the safety valve often hastens the explosion. It has been ascertained beyond all doubt, that explosions frequently follow immediately upon the opening of the safety valve. The cause of this paradox would still have been among the secrets of science, had not a recent discovery pointed out its source, and, I trust, that I shall be excused availing myself of the coinciding testimony of the celebrated Mons. Arago on this part of the subject.

In his publication on the explosion of steam boilers, he thus expresses himself: "How does it happen that a boiler bursts at the very moment of the opening of the safety valve? How does it happen that the accident is almost always preceded by an apparent diminution in the elasticity of the steam? These questions, involving seeming paradoxes, are suggested by the accidents recorded in this paper. Mr. Perkins has, I think, answered them satisfactorily; and I shall lay before the reader the explanation given by that engineer."

I now proceed with the explanation therein adverted to.

In one of my experiments in generating steam, I discovered that the temperature of steam was by no means the true measure of its

* See Mech. Mag. vol. xvi. p. 246.

power, although reposing on water, and that steam may be changed instantaneously from low to high steam of the strength of gunpowder, without any addition of heat. It is well known that in proportion to the *density* of steam, so is its power; and it was believed, that as steam increased in temperature, it would also increase in density, if in contact with water. This belief was the source of an important error.

In pursuing my experiments, though explosions frequently took place, they gave me the opportunity of witnessing some facts, never before developed to my knowledge. The first hint which I received was from the melting of the packing (which was of lead,) of the throttle valve. It appeared, by the indicator, that the temperature of the steam at the moment did not exceed four hundred degrees; but the lead which does not fuse under six hundred and fifty degrees, ran from the throttle valve like water; and permitted the steam to escape. The late Dr. Wollaston, who witnessed this new fact, was exceedingly struck with it. He accounted for it by supposing that the throttling of the steam occasioned sufficient friction to increase its temperature, so as to melt the leaden packing. As this was a plausible theory, I gave into it. But shortly after that experiment, I discovered that the steam pipe, leading from the generator to the steam engine, had ignited its non-conducting covering, which was of hempen cord, (to do which required at least eight hundred degrees of heat,) and I then became satisfied that friction was not the cause of the accumulation of heat, since during the last occurrence the steam was not throttled; and then I began to suspect that the steam, although in contact with water, had got *supercharged* with heat. I immediately instituted the following experiments:—

A generator was partially filled with water, and heated to about five hundred degrees, and was consequently exerting a force of about fifty atmospheres, or seven hundred and fifty pounds to the square inch; but the pressure valve being loaded to about sixty atmospheres, or nine hundred pounds to the square inch, it prevented the water from expanding into steam. The receiver, which was destitute both of water and of steam, was heated to about twelve hundred degrees. A small quantity of water was injected into the generator by the forcing pump, which forced out from under the pressure valve into the receiver a corresponding quantity of heated water, and this instantly flashed into steam, which, from its having ignited the hemp cord that covered the steam pipe ten feet from the generator, must have been of at least eight hundred degrees, which would be equal to about eighty atmospheres, or twelve hundred pounds to the inch; but from want of water to give it its necessary density, the indicator showed a pressure of only five atmospheres, or seventy-five pounds per inch. Whether the pressure of the steam which was rushing through the steam pipe was five or one hundred, or more atmospheres, the steam pipe kept up at the high temperature before mentioned, which I attribute to the steam being supercharged with caloric.

The pump was now made to inject a much larger quantity of heated water, and the indicator showed a pressure of from fifty to eighty

atmospheres. It soon expanded, (the throttle valve being partly opened,) to the former pressure of about five atmospheres. The water was then injected again and again, and the indicator was observed to oscillate at each stroke of the pump, from five to between forty and one hundred atmospheres, according to the quantity of water injected; clearly showing, that whenever the quantity of water was reduced, there was a great redundancy of heat, with little elastic force, and that the elastic force was suddenly increased by the mere addition of water. It soon occurred to me, that to this might be traced the true cause of the tremendous explosions that suddenly take place *in low as well as high pressure* boilers.

There are many instances where, immediately before one of these terrific explosions had taken place, the engine laboured, showing evidently a decrease of power in the engine. To illustrate this theory of sudden explosions, let us suppose the feed pipe or pump to be choked; in this case, the upper surface of the water would soon sink below some part of the boiler, which ought to be constantly covered by it, thus causing them to become heated to a much higher temperature than the water. The steam now being in contact with the heated metal, readily takes up the heat and becomes supercharged with it. Practical engineers have frequently witnessed the destruction of the packing of pistons by their becoming charred, although the steam issuing from the steam chamber was, in its lowest strata, in contact with the water, the temperature of which did not exceed two hundred and thirty degrees.

It was very evident that this steam was supercharged with heat, and was much above the temperature of the water upon which it was reposing, and in a suitable state to produce explosion, had the water been allowed to rise into and give the steam sufficient density, by any sudden *reduction of pressure* on the water in the lower part of the boiler, by drawing off part of the steam faster than it was generated.

Since caloric will not descend in water, it cannot be taken up by water placed below it. The steam thus supercharged, will heat the upper surface of the boiler in some cases quite red hot, and will ignite coals, or any other combustible matter, which may be in contact with it. This fact I can illustrate by numerous instances on record.

If the water, which is kept below the supercharged steam by the pressure of it, could by any circumstance, be made to take up the excess of caloric in the steam, as well as that from the upper part of the boiler, when heated above the temperature of the water in the boiler, whether the boiler be what is termed a high pressure or a low pressure boiler, the steam therein will instantly become highly elastic, and an explosion cannot be prevented *by any safety valve* hitherto used.

It was stated in evidence, at the coroner's inquest, taken in the Humber, in the case of an explosion on board of the Graham steamboat, that just before the explosion took place, twenty pounds weight was taken off the safety valve. Now, if the steam in that boiler had been properly generated, the relief given to the safety valve could

not have produced explosion; but if the water had got low in the boiler, (as was probably the case,) and the steam supercharged with heat, the most ready way to produce explosion was to open the safety valve, thereby allowing the water in the lower part of the boiler to rise suddenly and give density to the steam above it.

Several instances have occurred when there has been sufficient warning, by the rushing of the steam from a rent or fracture, for the bystanders to escape from injury before the explosion took place.

There has been at least one case, where the boiler was raised from its bed into the air by the force of the steam issuing from the rent, (upon the principle of the rocket,) before the water had sufficiently expanded, (by the removal of the steam caused by the rent or fracture,) to take up the heat of the boiler and supercharged steam, when an explosion took place after the boiler had been raised many feet in the atmosphere, and separated with a very great report, one part rising still higher, while the other dashed with great force on the ground.

The full persuasion of my mind is, that such explosions are remedial, by discoveries, which, for the moment, I cannot publicly mention, but which have been confidentially disclosed to an honourable member of this committee.

It is, I believe, a fact, that more persons have been killed by *low* than by *high* pressure boilers in this country, and such has decidedly been the case in America. High-pressure boilers have been substituted in Flintshire within the last twelve months, for those of low pressure, after a destructive explosion of the latter, by which sixteen lives were lost.

JACOB PERKINS.

Harpur Street, September 27, 1831. [*Mech. Mag.*

English Steam Boats.

THE subjoined article we copy from the Albany Daily Advertiser; we have been induced to transfer it to our pages from a conviction of the general correctness and value of the views which it presents. The writer, whoever he may be, is well acquainted with the subject upon which he speaks, and until the reformations suggested by him at the close of the article, or others of a similar character, are adopted, all our schemes for preventing explosions will prove abortive. Such, at all events, is the confirmed judgment of the EDITOR.

The increasing competition on our rivers by the proprietors of steam boats, not only as regards the beauty of their construction and the excellence of their accommodations, but their number and speed, is leading the American public to give the subject of steam their thoughtful consideration. This feeling of interest has been much increased by occasional losses of property, by reason of explosions and defective machinery. It is a singular coincidence, that while

our own government was endeavouring to elicit from our men of science, the causes of these accidents, and their proper remedy, that of England was led to make an examination into the causes of the casualties upon the Thames, resulting from the speed of the steam boats on that river, and occurring to the craft which came in contact with them. An investigation took place before a select committee of the house of commons, in September last, and the information elicited is so interesting, that we have taken some pains to present to our readers the most striking features of the examination.

It appears very evident that the English steam boats, even those of the best class, do not move with an average velocity of more than nine miles an hour. That their length is rather under than over one hundred and fifty feet, and their capacity much more frequently between eighty and one hundred and fifty tons than beyond it—their draught of water six feet and upwards.

Until lately their bows were blunt—now they are universally built sharp. Many of their old boats have been lengthened. They carry masts, and their chimnies are sometimes used as such. They consider a vessel not safe after five or six years wear, though some of extraordinary strength are reported to have lasted twelve years. A survey every three years or oftener, is thought necessary. The principal ship builders recommend making the hull nearly solid all the way up, with internal fastenings, trussings and diagonal bracings, the object of which, as avowed by Sir Robert Seppings, was to give "uniform strength from stem to stern." In this opinion the principal ship builders concurred.

As an evidence of the strength of their vessels, the instance of the Ramona was adduced, the Emulous, and Confiance. The former, of three hundred and eighty-five tons, and two engines of fifty horse power, went ashore in a storm at Bologne without injury, at a time when other vessels were sunk. The Emulous went out safely to India, and is now employed in towing vessels on the Ganges, while the Confiance, a government packet, has been out at sea in all weathers, and according to the report of her commander, he has never been obliged to lay to with her. Among other things, he stated that he towed a French corvette in a gale with five hundred troops on board, at the rate of six miles per hour, for five hundred miles distance! It appears that there are forty-two steam boats belonging to the Thames in active service, and eleven that sail out of London to foreign ports. Two passengers per ton, of registered burthen, are considered a fair allowance, although four are oftener carried.

The machinery of these vessels is altogether on the low pressure principle. There is only one high pressure boat known, and that belongs to a French company and plies to Dover.

Generally they have two engines in their boats, not fastened to the timbers at the bottom of the vessels, but usually at the sides. The boilers now getting into fashion are the cylindrical, though the greater part are like those used in our own boats. The average pressure is four pounds per square inch; if it exceeds that much, it is thought

very dangerous. Explosions from the boilers are hardly known in England. Their engineers prefer a short to a long stroke of the piston, and small water wheels. They can throw their wheels out of gear at any time, and prefer that method of working their engines when lying to or preparing to start. The Canadian boats are almost all so constructed. A pressure of fifteen pounds is thought to be high pressure. The engines are stopped and started as ours are. The throttle valve appears to be the great dependence of the engineer, and very elaborate experiments were made in a government steamer, to ascertain the relation between the aperture of the valve, and the rates of going in consequence. A boat on the Tay is managed by an index on deck, a small revolving lever, which points to "stop her," "go ahead," "back her," and which any common seaman who can read may manage. Captain Hall says that he was six hours in a boat of this character, manœuvring her in every possible way, during which this hand gear must have been used fifty or sixty times, and yet the engineer never touched the engine. There is an account of this apparatus and a drawing accompanying it, in the Edinburgh Philosophical Transactions.

The English boilers are manufactured chiefly of iron, and are considered to be good for three years only. In the best boats, new ones are always substituted after this period, or the most thorough repairs made to the old at the shops of the maker. They are always placed below deck. In stopping an engine some English engineers think it highly important to regulate the injection cocks as well as the throttle valves; they reckon also, every ton of engine as equal to the power of one horse.

In many steam vessels in the united kingdom, the engine is worked on the deck as in our own.

The general management of the boats is by the captain, mate, steward, pilot, engineer, (first and second,) and a crew of from eight to twenty-five in number, proportioned to the size of the vessel. These vessels are steered by a tiller. Captain Hall has for a long time attempted to introduce the American mode of steering by a wheel. One naval officer who was examined on this point, said it would not do. Another said it would be an excellent improvement: and a pilot swore that steering was principally directed by motions made by hand. At night, however, the lookout gives his warning voice to the pilot. On the St. Lawrence, the noise occasioned by this practice will be readily recollected by American travellers.

The pilot also directs the engineer by his voice, and not by means of a bell, as in our boats.

The boats usually carry a light at the mast head and on each paddle box; and not at the bow, as with us. Captain Hall mentioned the greater brilliancy of American steam boats at night, in consequence of the furnaces being on deck, and the blaze and sparks made by the pine wood which is used for fuel.

A great variety of paddles have been tried in England; among them are the feathered, still in use, Skene's revolving paddle, out of use, and Morgan's, which is in use with some of the government

packets. The latter made a difference of almost one-third in favour of the Confiance's speed, lessened the tremor of the boat, and works proportionably faster in a heavy head sea than a calm. The engineer of this vessel describes the bucket as entering the water at an angle of 57½°, and leaving it at 52½°, while the old worked at an angle of 25°. There is said to be no backwater of consequence, and she has towed a boat close to the water wheel without danger.

The London boats are unpopular among the wherrymen, frequently running over and destroying them. This practice appeared to grow out of the carelessness of the wherrymen, and the narrowness of the channel.

The accommodations of these boats are not to be compared to ours.

Upon a review of the subject, we are led to the irresistible conclusion that the English steam boats are not as substantial, nor as fast, nor as comfortable as ours; but they are far safer. On the Hudson river our boats are on the low pressure *plan*, but they carry from sixteen to twenty-five inches of steam, and this is nothing more nor less than high steam. The shape of our boilers is not calculated to resist such a pressure, and some tremendous accident will sooner or later occur to spread ruin and death among the crowds who venture themselves within their reach.

It certainly is possible, now that large boats are becoming so popular, to work steam at a low pressure, and to the greatest advantage; or if high steam must be used, let the cylindrical boilers come again into use.

The competition will inevitably lead to fatal consequences if public opinion does not rectify the errors of our steam navigation.

¶ *On Madder.*

(Ger. *Färberothe*; Du. *Mee;* Fr. *Alizari*, *Garance*; It. *Robbia;* Sp. *Granza*, *Rubia;* Rus. *Mariona*, *Krap;* Hind. *Munjith.*)

Madder is the roots of a plant, (*Rubia tinctorium*,) of which there are several varieties. They are long and slender, varying from the thickness of a goose-quill to that of the little finger. They are semi-transparent, of a reddish colour, have a strong smell, and a smooth bark. Madder is very extensively used in dying red; and though the colour which it imparts be less bright and beautiful than that of cochineal, it has the advantage of being cheaper and more durable. It is a native of the south of Europe, Asia Minor, and India; but has been long since introduced into and successfully cultivated in Holland, Alsace, Provence, &c. Its cultivation has been attempted in England, but without any beneficial result. Our supplies of madder were, for a lengthened period, almost entirely derived from Holland, (Zealand;) but large quantities are now imported from France and Turkey.

Dutch or Zealand madder is never exported except in a prepared or manufactured state. It is divided by commercial men into four qualities, distinguished by the terms *mull*, *gamene*, *ombro* and *crops*. The roots being dried in stoves, the first species, or mull, consists of a powder formed by pounding the very small roots, and the husk

or bark of the larger ones. It is comparatively low priced, and is employed for dying cheap dark colours. A second pounding separates about a third part of the larger roots; and this, being sifted and packed separately, is sold here under the name of gamene, or gemeens. The third and last pounding comprehends the interior, pure, and bright part of the roots, and is sold in Holland under the name of *kor kraps*, but is here simply denominated crops. Sometimes, however, after the mull has been separated, the entire residue is ground, sifted, and packed together under the name of *onberoofde*, or ombro. It consists of about one-third of gamene, and two-thirds of crop. Prepared madder should be kept dry. It attracts the moisture of the atmosphere, and is injured by it.

The Smyrna or Levant madder, (*Rubia peregrina*,) the alizari or lizary of the modern Greeks, is cultivated in Bœotia, along the border of lake Copais, and in the plain of Thebes. It also grows in large quantities at Kurdar near Smyrna, and in Cyprus. The madder of Provence has been raised from seeds carried from the latter in 1761. Turkey madder affords, when properly prepared, a brighter colour than that of Zealand. It is, however, imported in its natural state, or as roots: the natives, by whom it is chiefly produced, not having industry or skill sufficient to prepare it like the Zealanders, by pounding and separating the skins and inferior roots; so that the finer colouring matter of the larger roots being degraded by the presence of that derived from the former, a peculiar process is required to evolve that beautiful Turkey red which is so highly and deservedly esteemed.—(*Thomson's Chemistry; Bancroft on Colours*, vol. ii. pp. 221—278: see also *Beckmann, Hist. of Invent.* vol. iii. art. *Madder.*)

In France, madder is prepared nearly in the same manner as in Zealand. The following instructive details as to its cultivation, price, &c. in Provence, were obligingly furnished to us by an English gentleman intimately acquainted with such subjects, who visited Avignon in the autumn of 1829.

"This town, (Avignon,) is the centre of the madder country, the cultivation of which was introduced here about the middle of the eighteenth century, and, with the exception of Alsace, is still confined, (in France,) to this department, (Vaucluse.) The soil appears to be better adapted for its cultivation here than any where else, and it has long been the source of great wealth to the cultivators. Of late years, however, the prices have fluctuated so much, that many proprietors have abandoned, or only occasionally cultivated this root, so that the crop, which was formerly estimated to average 500,000 quintals, is now supposed not to exceed from 300,000 to 400,000.

"The root is called *alizari*, and the powder, (made from it,) *garance*. The plant is raised from seed, and requires three years to come to maturity. It is, however, often pulled in eighteen months without injury to the quality, the quantity only is smaller. A rich soil is necessary for its successful cultivation; and when the soil is impregnated with alkaline matter, the root acquires a red colour—

in other cases it is yellow. The latter is preferred in England from the long habit of using Dutch madder, which is of this colour; but in France the red sells at two francs per quintal higher, being used for the Turkey red dye.

"It is calculated that when wheat sells at 20 fr. per hectolitre, *alizari* should bring 35 fr. per quintal, (poids de table,) to give the same remuneration to the cultivator. That is, wheat 63*s.* per Eng. quarter, and *alizari* 34*s.* per Eng. cwt. The price has, however, been frequently as low as 22 fr. per quintal.

"Prices undergo a revolution every seven or eight years, touching the minimum of 22, and rising as high as 100 fr. As in every similar case, the high price induces extensive cultivation, and this generally produces its full effect four or five years after. The produce of Alsace, which is inferior both in quantity and quality to that of Vaucluse, is generally sold in the Strasburg market.

"England employs both the root and the powder, according to the purpose for which they are intended. The Dutch madder is more employed by the woollen dyers, and the French by the cotton dyers and printers.

"In making purchases of *garance* it is essential to employ a house of confidence, because the quality depends entirely upon the care and honesty of the agent. The *finest* is produced from the roots after being cleaned and stripped of their bark. The *second* by grinding the roots without cleaning. A *third* by mixing the bark of the *first* while grinding; and so on to any degree of adulteration.

"The price of *alizari* in the country, which was only 25 fr. in July, is now, (November,) 1829, at 36 fr. and is expected to be 40 fr. very shortly. The crop being deficient both here and in Holland, and the certainty of its being also deficient next year, added to the small quantity existing in England, give reason to believe that the price will reach 60 fr. before many months, and will continue to advance for a year or two more.

"The *quintals* above mentioned are of 100 lbs. *poids de table*—the weight in general use over the south of France, and even at *Marseilles*. This weight is different in the different provinces, varying from 22 to 25 per cent. lighter than the *poids métrique*. At Avignon 124 lbs. p. de table = 50 kilog., consequently 126 lbs. are equal to 1 cwt. Eng. At the exchange of 25.50, the cwt. costs, (including 11*s.* for freight, duty, and all charges till delivered in London or Liverpool,) 61*s.* or 60*s.* The selling price is quoted in England at 62*s.* only.

It is considered that only one-sixth or one-seventh of the present crop remains for sale.

Madder does not deteriorate by keeping, provided it be kept dry.

Compte simulé.—	Fr.
Cost of one quintal of roots in the country - -	35
Expenses in do. - - - - -	2
	37

The root gives 85 per cent. powder, consequently 1 quintal

powder	=	43.50
Grinding	"	2
Cask	"	1
Transport	"	2.50
		F. 46.75

	Fr.
The English cwt. costs, therefore,	58.85
All expenses till on board at Marseilles	3
	F. 61.85

Besides commission.

For an account of East India madder, or munjeet, see munjeet.

The imports of madder have not materially varied for a considerable period. Of 70,017 cwt. of prepared madder imported in 1829, 38,579 were brought from Holland, and 31,352 from France. During the same year the imports of madder root amounted to 33,541 cwt. of which 14,592 were brought from France, 14,007 from Turkey and Greece, 2,376 from Holland, and 2,135, (munjeet,) from India. The exports of Madder from Great Britain are trifling.

The duty on madder is 6*s.* per cwt. on prepared, and 1*s.* 6*d.* per do. on roots; and its price, duty paid, in the London market, October 1831, was as under:—

	£	*s.*	*d.*		£	*s.*	*d.*	
Madder, Duch Crops	4	0	0	to	4	10	0	per cwt.
Ombro	3	5	0	—	3	15	0	—
Gamene	2	3	0	—	3	12	0	—
Mull	1	0	0	—	2	2	0	—
French	0	0	0	—	4	5	0	—
Spanish	2	16	0	—	3	9	0	—
Madder Roots, Turkey	2	10	0	—	2	12	0	—
French	2	8	0	—	2	9	0	—

Madder is not to be imported for home consumption except in British ships, or in ships of the country of which it is the produce, or from which it is imported, under forfeiture of the same, and 100*l.* by the master of the vessel.—(6 *Geo.* 4 c. 109; 7 & 8 *Geo.* 4. c. 56.)

[*Com. Dict.*

Extinction of Fires in Factories.

Sir,—May I desire of you to insert in your valuable periodical two letters which I published in two provincial papers, respecting the extinction of fires in factories, and to which I see you have alluded in one of your late numbers, (page 240, vol. xvi.) I am induced to make this request, with a design of making them more extensively known than they possibly could be through the medium of their original publication, and with the hope that they may lead to some im-

portant results. I desire also to correct some errors contained in your brief notice of them in the number to which I have alluded.

Yours, &c.

Jan. 1, 1832. T. WATERHOUSE.

I. Letter from Mr. Waterhouse to the editor of the Preston Chroncile.

SIR,—Having observed in your Chronicle of last week, an account of the destruction of Messrs. Eccles's factory by fire, I beg permission, through the same medium, to suggest a plan by which similar conflagrations might be in a great measure prevented.

It is well known that steam possesses the power of speedily extinguishing combustion, that it can be generated in factories even during the night in ten minutes or a quarter of an hour, and that it can be diffused through almost any space in a few minutes. Upon these facts my plan is based—it is the following:—Let there be a pipe connected with the steam boiler, larger or smaller, according to the extent of the building. Let this pipe pass up the staircase, and from it, one or two smaller pipes branch off into each room. These branches should extend from one end of the room to the other, and a number of apertures should be drilled into them at certain distances, say two feet asunder. To the branch, or branches, before they enter the room, let a stop cock be fixed, and let the main pipe, as it issues from the boiler, be supplied with another stop cock. When a fire is discovered in an apartment, if in the night time, the person who makes the discovery, instead of wasting a considerable length of time in alarming the neighbourhood, will merely have to go and turn the cock that is affixed to the branch, and the one belonging to the main pipe, and then add a quantity of fuel to the fire to generate the steam. By these means the room may be filled with steam, and the conflagration consequently extinguished in at least twenty minutes. If in the day time, by simply turning the cocks the fire might be subdued in five minutes. This is the whole of the plan, and of its success I have no doubt, unless its simplicity prevent its adoption.

The advantages of this method of extinguishing conflagrations over those which are at present employed, are many and important. When fire engines are employed under the most favourable circumstances, as when they are kept upon the premises, and men at hand to work them, it is often found to be difficult to subdue a considerable conflagration. The stream of water can only be propelled upon a very limited portion of the building at once, and that not always the part where the fire is most active. And should their employment be crowned with success, the buildings must be almost deluged with water. If engines are not on the premises, a very great loss of time may be sustained before they can be procured, as was the case when Messrs. Eccles' factory was consumed, where the engines did not arrive till two hours after the fire was discovered. Engines are often out of repair, and much time is frequently lost in procuring a sufficient number of men to work them. I am aware that in some factories water can be forced through the buildings by the engine in pipes arranged for the purpose. Even according to this plan, the engine

must be put in action before the water can be propelled; a large quantity of water must still be ejected to quench the flame; the presence of a person to direct the current of the water is required, and the cold water will condense the heated air in the room, and cause a great influx of air from without, a circumstance which will materially contribute towards maintaining the combustion. By the plan which I have suggested, a boy might extinguish almost any conflagration. The time occupied in putting it in force, would only be ten or fifteen minutes at night, and not more than five minutes in the day time. The presence of no one to direct its operations would be necessary, and it might be made to act on every part of the building at once; the quantity of water expended would not, at the most, exceed a few gallons; and instead of promoting an influx of air into the room, the steam would displace that which was in the apartment previous to its admission; besides, the injury that the machinery would sustain, would be considerably less than is occasioned by the mode at present adopted.

These are advantages such as I trust will induce some of the proprietors of mills to give the scheme their deliberate consideration. I am sanguine enough to believe, that if it were employed, almost a perfect immunity from fire would be possessed, and insurance might be wholly dispensed with. I must apologise for the length of this letter, but I trust you will not deem me presumptuous, when you consider that my object is to point out a method of protecting property, and to prevent the distress incident to the work people from its destruction. These considerations, I hope, will induce you to give these remarks publicity, and prevent you from excluding my communication because of its extension.

I am, sir, your humble servant,

Preston, Sept. 27, 1831. T. Waterhouse.

II. Letter from Mr. Waterhouse to the editor of the Lancaster Herald.

Sir,—Having observed in your Herald of last week, a paragraph relative to the extinction of fires in sugar houses, &c., by means of steam, may I be permitted to make known to the readers of your excellent paper the following experiments, which, by the extreme politeness of Mr. William Taylor, of Preston, and with the assistance of some friends, I have been able to make on this interesting and important subject, on a large scale.

"The drying house connected with the moss factory was the place selected for the purpose. It is twenty-six feet long, fifteen wide, and about twelve feet high. In the centre of this room was placed a large iron platform, erected on bricks, to prevent the floor from sustaining any injury from the fire; and a quantity of sheet iron was suspended above, to protect the roof. To a large pipe beneath the floor, a branch, about two yards long, and two inches in diameter, was affixed, furnished with a tap. The main pipe communicated with another issuing from the boiler, which was at a considerable distance. Having closed every aperture through which atmospheric air might have gained ingress, and allowed the steam to flow into the pipes

until they were sufficiently warmed, we piled a quantity of shavings and oily cotton waste on the centre of the iron platform, out of the current of the steam—ignited them, turned the tap, and closed the door. The steam being subjected to a pressure of about four pounds on the square inch, rushed into the apartment with considerable velocity, and soon filled it with a dense vapour. We watched the effect produced through a window, and in five minutes we observed the flame to flicker and expire, when the room was in total darkness, it being night. On opening the door, nothing could be perceived, but in a few minutes the smoke and steam subsided, and then a few red embers were discernible. In a few minutes more, the atmosphere in the room became clear, and the embers partially kindled up again. This experiment was repeated two or three times with a similar result, although in one of them pieces of wood were used instead of shavings and cotton waste. In the experiment with the fire of wood, after we had ascertained that the flame was extinguished, we re-closed the door, and allowed it to remain so for fifteen minutes longer. On again opening it, after the expiration of that time, we found that the embers were still burning, but dimly; and on admitting a free access of atmospheric air, were again inflamed. These experiments were tried on the 12th of this month, in the presence of Mr. William Taylor, Mr. Adcock, lecturer on mechanical philosophy, Mr. Elsworth, civil engineer, Mr. Harrison, surgeon, and several practical engineers and spinners. On Thursday the 17th, assisted by Mr. Harrison, I repeated the experiment with a little variation in the same room. We procured a stove grate from Mr. Taylor, kindled a quantity of coke in it, placed it on the platform, out of the direction of the mouth of the branch pipe, and allowed the steam to rush into the room, with a pressure of three and a half pounds to the square inch. We observed that the fire lost much of its intensity, but could not be extinguished. The grate was then removed into the current of the steam, distant from the mouth of the pipe about six feet, when we observed that the coke burnt with great brightness, and a lambent flame issued from the top of the grate. It was obvious that the steam in this experiment was decomposed when it came in contact with the fire, the oxygen meeting with carbonaceous base, and the hydrogen burning on the surface, and uniting with the oxygen of the atmosphere to form water. The coke was then removed from the grate, and its place supplied with shavings and cotton waste. The grate was then placed out of the direction of the steam, the combustibles ignited, the steam allowed to rush into the room, and the door closed. The flame was extinguished in five minutes, as before; but the embers were still smothering, though not sufficient fire remained to rekindle the combustible matter until the grate was brought out of the room into the cold atmosphere. This experiment was several times repeated with the same result. A lantern was then procured and suspended from the ceiling, about two and a half yards above the steam pipe, lighted, and the steam allowed to issue from the pipe while the door was kept open. In a quarter of a minute the light was put out. The back of the lantern was then turned towards the opposite wall,

against which the steam was driven, and the recurrent steam was prevented from coming directly against the light by the door of the lantern, so that it could not act upon it till it was generally diffused. In this experiment, the light was extinguished in thirty-five seconds. We had now indubitably proved that flame could be put out by steam in a close apartment in a few minutes, when the conflagration was considerable; and in a few seconds in an open room, when small. And it now remained to ascertain if steam would exert any influence over flame, when a free access of atmospherie air was permitted. This we tried by kindling a fire in the grate of shavings and cotton waste, and placing it out of the current of the steam, while the door was kept wide open. In this experiment the flame expired in four and a half minutes.

Observations.

By these experiments it is proved—

1st. That steam will extinguish a large conflagration in a close apartment in five minutes, when it is driven into the room in considerable quantity.

2nd. That it does not possess the power of preventing a low or charring combustion.

3d. That when a current of steam is impelled against a large fire, it increases the combustion in a remarkable degree.

4th. That a small flame is almost immediately extinguished when suspended in an open apartment into which a considerable volume of steam is rushing.

5th. That steam will subdue flame in an open room as rapidly as in a close one.

From these facts I am disposed to infer, that steam would be of great use in restraining conflagrations in factories or other places where it could be rapidly generated in large volumes; and that it would be of great service, especially in such buildings as are at a considerable distance from engines, or where some length of time must elapse before assistance can be procured, as the watchman could, in fifteen or twenty minutes, diffuse a sufficient quantity to arrest the flame, if pipes were properly arranged for that purpose, according to a plan I laid before the public a few weeks ago in the Preston Chronicle. In all factories in which the conflagrations are very rapid, from the combustibility of the materials they contain, it would be of great use, from the same cause (its easy application,) and would considerably lessen the quantity of water that would afterwards be required to totally quench the burning embers. I fear, sir, that I have already encroached too much upon your columns, but I trust the importance of the subject will be admitted as an apology.

I am, sir, yours respectfully,

T. WATERHOUSE.

Preston, Nov. 19, 1832.

Defence against Flies used by the Butchers of Geneva.

It is said that the butchers of Geneva have for a long time used the oil of laurel as a substance which prevents the flies from approaching their meat. The odour of this oil, though strong, is not very disagreeable, and the flies will not approach the walls or parts which have been rubbed with it. The person who describes these effects says, that he has, in this way, guarded the gilt frames of mirrors and pictures more perfectly from flies. [*Recueil Industriel.*

Meteorological Observations for May, 1832.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches.				Inches.	
⊗	1	44°	61°	29.65	29.62	29	W.	Blustering.		Clear—flying clouds.
	2	36	51	.84	.84	25	W.	Moderate.		Cloudy—clear.
	3	42	56	.53	.40	47	SE. W.	Blustering.	.21	Rain—flying clouds.
	4	33	52	.84	.80	20	W.	do.		Clear day.
	5	35	44	.90	30.00	12	N. NW.	do.		Clear day.
	6	26	42	30.20	.20	11	N. NE.	Moderate.		Clear day.
☽	7	28	50	.10	.00	26	E.	do.		White frost—hazy.
	8	36	49	29.90	29.90	19	N. NW.	do.		Clear day.
	9	36	44	30.15	30.20	10	N. E.	do.		Clear day.
	10	32	52	.20	.10	25	SW.	do.		Cloudy—clear.
	11	38	68	29.90	29.80	40	SW. S.	Breeze.		Cloudy—hazy.
	12	46	72	.80	.80	44	W. S.	Calm.		Hazy day.
	13	46	76	.73	.70	47	W. S.	do.		Clear—hazy.
☺	14	50	79	.60	.60	38	SW. W.	Blustering.		Hazy day—very dry.
	15	45	46	.70	.74	34	SE.	do.		Cloudy day.
	16	36	44	.70	.57	40	E.	do.		Drizzle—drizzle.
	17	44	48	.50	.50	44	NE.	do.		Drizzle—drizzle.
	18	44	47	.60	.70	41	NE.	Moderate.	1.30	Drizzle—cloudy.
	19	42	48	.60	.60	43	N. NE.	do.		Drizzle—cloudy.
	20	42	48	.60	.60	37	N. W.	do.	.05	Drizzle—cloudy.
	21	43	58	.74	.74	33	NW.W.	do.		Clear day.
☾	22	49	60	.83	.83	28	NW.	do.		Clear day.
	23	41	58	30.00	.95	28	E.	do.		Clear—cloudy.
	24	40	54	29.90	.92	37	NW.	do.		Cloudy—clear.
	25	48	62	.90	.90	54	S.	Blustering.		Cloudy day.
	26	50	70	.70	.60	56	SW.	do.		Clear—hazy.
	27	55	70	.60	.70	58	S.	Moderate.	.27	Cloudy—clear—rain.
	28	40	50	.70	.90	36	E. NE.	do.		Cloudy day—rain.
	29	42	49	30.00	30.05	42	S. E.	do.	.10	Drizzle—cloudy.
⊗	30	41	44	.00	.00	42	S. E.	do.	.54	Rain—cloudy.
	Mean	41.00	55.07	29.81	29.81	34.83			2.37	

	Thermometer.	Barometer.
Maximum height during the month,	79. on 14th.	30.20 on 6th, 9th, and 10th.
Minimum do. . . .	26. on 6th.	29.40 on 3d.
Mean do. . . .	48.03 . .	29.81

# JOURNAL

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OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

JUNE, 1832.

Notes of an Observer.—*On the Expenditure of Mechanical Power.*

If the reader will turn to the number of this journal for March, p. 201, he will find an article extracted from the Register of Arts, containing, as I conceive, a very erroneous method of calculating the power expended in propelling a coach on a turnpike with different velocities.

It appeared, by a series of experiments made by Mr. Macneil, under the superintendence of Mr. Telford, on the London and Liverpool road, in which the force of traction was very accurately ascertained by means of an improved dynamometer, that this force constantly increased with an increasing velocity.

The writer who makes remarks on these experiments comes to the conclusion, that when the velocity is increased from six miles an hour to ten, "there is a saving of nearly one-third of the power expended in conveying a given load the same distance. For although it takes a greater power during the same space of time to draw it at a high than at a low velocity, the gain is in the increase of space passed over by a given power in a given time. No advantage can, however, be taken of this circumstance, with carriages drawn by horses, as horses can exert but little power of draught at high velocities; but in locomotive carriages the case is otherwise," &c.

Now if the power expended is to be calculated by the force of traction multiplied by the *time* in which a particular distance is passed over, the deductions of the writer in question would be correct; but this is not the fact. The force of traction must in all cases be mul-

tiplied into the *space* passed over, without regard to the time, when we wish to know the power expended. And where the force of traction is the same at all velocities, as it is on rail-roads, the power expended will be the same in going a given distance whatever the velocity may be.

The writer in question will undoubtedly agree with me that the power expended is in proportion to the quantity of coals used, or which is the same thing, the quantity of steam. Now if he will consider that in running on a rail-road, the force of traction—that is, the density of the steam, is the same at all velocities, he will easily perceive that the quantity of steam used in a given time, will be as the velocity, that is, a double velocity will expend double the quantity of steam, and a triple velocity, a triple quantity, &c. in the same time.

Therefore, *the quantity of steam used is as the space passed over without regard to time.*

If, however, the force of traction increases with the velocity, as in the experiments mentioned above, then the quantity of steam used in passing over a given space will increase with an increased velocity; consequently the power expended, that is, the quantity of steam used, will be greater with high velocities than low, in direct proportion to the force of traction.

I do not know whether any practical man could be led astray by the writer whose error is here corrected, but I thought it ought not to pass without notice.

In conclusion I observe that the views of Mr. Green, who furnished the experiments mentioned above for publication, appear to me to be correct, for he says they are communicated to the editor of the Repertory for the express purpose of correcting the error which almost universally prevails, that it requires less power to work a coach at a high than at a low velocity.

FRANKLIN INSTITUTE.

Explosions of Steam Boilers.

The subjoined communication has been received by the Committee on Explosions since the publication of the series terminating with No. XXVII, in vol. ix. No. 2, of this Journal.

(No. XXVIII.)

Letter from Thomas Ewbank, dated

New York, March 11, 1832.

Gentlemen,—The limited experience which I have in the subject to which your inquiries are directed, induces me to believe that all explosions of steam boilers, may be accounted for by the following causes: 1st. Defects in the construction of the boilers. 2nd. Excessive pressure of steam. 3d. Deficiency in the supply of water. 4th. Neglect. Several of these causes may sometimes combine to produce explosion.

1st. Boilers constructed with interior flues are defective from the nature of the construction, or from the form, situation, &c. of the flues. These, when made of the same material as the boiler, are, from their inferior diameter, almost infinitely stronger than the boiler can be; and ought certainly to be the last parts to give way. From the frequency of their rupture, it is evident that something about them is defective.

It may be said that the action of fire on their interior surface tends to wear them away; but they could only be affected by this cause in the same proportion as the bottom of boilers; this, therefore, does not account for the frequency of ruptures in them. Indeed, if flues are formed of copper and kept clean, with a sufficiency of water always above them, this action of the fire could not, in *many years*, essentially affect them. We see that a common copper tea kettle will last from twenty to fifty years in constant use, although the thickness of the metal, compared with that of a steam boiler, may be but as 1 to 12 or 15. The resistance of steam which flues have to endure, can hardly effect the *wear of the metal*, its tendency being rather to *strengthen* it by compression than otherwise. It has been suggested to discontinue altogether the use of interior flues, and thus cut off one great source of danger. There does not appear any very formidable objection to the adoption of this advice.

The danger arising from flues is considerable, not only on account of their proximity to the surface of the water, so that from a small deficiency, or the lurch of a boat, their upper surfaces become improperly heated, and their strength essentially impaired, but also from the fact of their expansion and contraction being unequal to those of the boiler in which they are placed.

When the *ratio* and *time* of expansion are not the same in both boiler and flues, (and it would be difficult to make them agree in these,) they then have a tendency to injure each other. Large boilers expand unequally, and necessarily so, their lower parts exposed to the fire, being kept at a much higher temperature than the upper parts. They also, from their superior capacity and the quantity of water over the parts exposed to the fire, probably expand more slowly than the flues, (this, however, will perhaps depend considerably on the kind of fuel used,) which latter, from their smaller surface, and the less quantity of water above them, together with the impinging of the flame against their sides in passing through them, are heated more readily. Flues are, besides, placed in that portion of a boiler which expands the least.

It matters not, however, whether the boiler or the flue expand soonest; the effect is the same so long as they do not expand *equally and in the same time*. The *amount* of expansion will of course vary with the material of which they are formed and its thickness. In some experiments which I made upon a wrought iron cylindrical boiler twenty feet long, two feet in diameter, and three-sixteenths of an inch thick, the length increased one line for every forty degrees of temperature: hence I conclude that a twenty feet iron flue, will, in

use, undergo an increase in length of from three-quarters of an inch to an inch, and a copper one still more.

If the ends of a boiler to which such a flue is attached, (and it expands more quickly than the boiler,) be made of cast iron, then either those ends must spring as the flue expands, or, the body of the boiler must be strained by the irresistible energy of this power. And should there be a weak or imperfect part in the boiler, it will find it out, and be exerted principally upon it.

When the ends of a boiler are of considerable extent, as those used in boats on the Hudson, and formed of wrought iron or copper, this unequal expansion of flues does little injury, because the ends yield readily to it, without always affecting the *same place* in the metal. But in smaller, or high pressure, boilers, with ends of wrought iron, as those used in the western waters, the effect of the flues is to protrude and draw in alternately those ends, the strain of the metal being almost always in the *same place*, and near their periphery; its action being similar to the bending a piece of metal backwards and forwards until it breaks.

When flues cool sooner than the boiler, the contraction is also exerted on the joints by which they are attached to it, which tends to start and cause them to leak. When parts of either boilers or flues are heated to redness through a deficiency of water, or other cause, their strength is diminished by the consequent expansion, as well as by a loss of tenacity from the heat.

Ruptures of flues are also influenced by the *materials* of which they are formed. When the top of a flue is not covered with water, the intense blast of flame passing through it, is capable of heating it to redness almost instantly, and consequently of destroying essentially its power of resistance. An *iron* flue under such circumstances, if not collapsed by the steam, would *not* have the *texture of the metal materially injured.* But the danger from a *copper* flue when thus heated is imminent, because whenever copper is heated to a bright red, or a little over the melting point of spelter solder, its tenacity is *completely destroyed, nor can it ever be recovered.* It becomes as brittle as spelter, and cannot be bent without breaking. This fact is well known to all coppersmiths; for in brazing, should the copper become "burnt," as it is technically termed, the burnt part must either be cut out, or the whole article thrown aside. The same effect, though in a less degree, is, I believe, caused by frequently heating copper to redness. Hence copper flues are more dangerous than those of iron, when exposed to fire unprotected by water, and new flues offer no more security from this evil than old ones. There was, therefore, no cause for surprise, when the flue of a new copper boiler was rent the first time it was used.

The flue of the "Chief Justice Marshall," I believe, was ruptured from this cause, and the appearance of the metal, (being full of irregular cracks all around the fracture,) indicated this. A diagram, representing the fracture, &c. with remarks, made soon after the accident, having been mislaid, I am unable to attach it to these observations.

When water once begins to subside below the flue of a steam-boat boiler, the enormous consumption of steam by the engine, rapidly reduces it; and should a supply of water be delayed for a few moments, the parts exposed, if of copper, would, in all probability, become "burnt," when the certainty of an explosion would be almost equal to that of the discharge of a musket, when the trigger is pulled. But if explosion, under such circumstances, did not take place *at that time*, the strength of the flue would be destroyed, the texture of the "burnt" part deranged, and its tenacity or ductility annihilated. To trust to a boiler with such a flue, is to "repose on a volcano." The same observations apply to the parts of copper *boilers* after being so exposed.

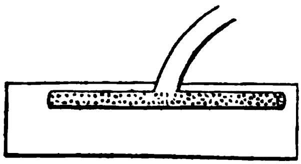
So long as the use of flues is continued, their *form* ought invariably to be cylindrical, this being the strongest shape which they can have. They are too frequently made in irregular ovals, merely to accommodate them to their position in boilers, as "kidney flues," &c. When the section of a flue is a circle, the steam, by pressing on it externally, tends to *strengthen* or *thicken* the metal by compression, in direct opposition to its influence on the interior surface of boilers when its tendency is to dilate or make the metal *thinner*. It would appear perfectly impossible for steam of any power to collapse a truly cylindrical flue; unless the strength of a part of it be first diminished or destroyed, as when exposed to fire uncovered by water.

Another defect in flues, as ordinarily used, is in their *situation*, being placed too *high*, or not having a sufficient depth of water over them. Few boilers are designed to have more than from three to six inches of water over the flues, while others have not more than one or two. In the boilers of stationary engines, three or four inches may suffice, if that depth be uniformly preserved; but in steam-boats where the level is constantly liable to considerable change, a greater depth ought certainly to be allowed, so that from six to eight inches of water should be over the flues, under all the ordinary changes of position of the boat. The situation of the boilers themselves, should, in some measure, regulate the depth of water required above the flues. When they are placed on the guards, their flues require more water over them than when placed in midship.

A further reason why flues should have a greater depth of water over them than is usually allowed, is to be found in the *repulsive power of heat*. The upper part of a flue is the hottest part, consequently the repelling power of that part is greater than that of any other; while at the same time, the least quantity of water is over it: thus the least resistance is opposed to this power where its energy is greatest. This repulsion produced by heat may readily be observed by dipping the point of a wire, (a knitting needle for example,) in the tallow of a candle, and collecting as much upon it as will form a drop; by moving the point into the flame, the heat will repel the tallow upwards, although held at an angle of forty-five degrees; and if continued in the flame, it may be brought to a vertical position, and yet the drop be prevented from falling down, which it will instantly do as the wire cools, when withdrawn from the flame. The same

principle is shown by Mr. Perkins, in making an aperture in the side of his generator, while at a red heat.*

The effect just explained is probably somewhat increased by the agitation produced within a boiler when steam is admitted to the cylinder. When steam is raised in a boiler, and the engine not working, the water within (if the flues are sufficiently covered,) is probably on a level and nearly at rest; but as soon as steam is admitted into the cylinder, it causes an ebullition of the water, which rises towards the mouth of the steam pipe, in consequence of a portion of the pressure upon it being *suddenly* removed at every stroke of the piston.



This might, I think, be prevented by continuing the steam pipe an inch or two into the boiler, and then branching it off towards each end of it, with small apertures in its sides and ends, as in the diagram.

In this manner, the steam would be equally withdrawn from every part of a boiler, instead of being violently agitated in rushing to one place. Such a tube attached to the aperture of a *safety valve*, would be equally advantageous; or the valve might be placed on one end of the tube leading to the cylinder. This tube might be made of very thin copper, as the pressure on it would be inconsiderable.

Again, a greater depth of the water over flues of steam-boat boilers should be allowed because the ordinary quantity is seldom sufficient to prevent danger after a defect in the means of supply is discovered. The attendant of an engine does not always know the precise moment when the water begins to fall below its proper level; he is only informed of it when he opens the gauge cock. Moreover, gauge cocks are not always certain criterions of the quantity of water in boilers, and even when they are, the supply pump does not always answer the demand of the gauge cocks; a circumstance often unknown to the engineer until the cocks, at some time after the first deficiency is seen, have confirmed a further deficiency, instead of indicating the anticipated supply.

Boilers in steam-boats necessarily partake of the motion of the boats, which renders it difficult to preserve the water at a uniform level; and although a sufficient quantity may be in them when on a level, yet, from their motion, part of the flues will be exposed, unless the supply be sufficient to cover them in the new position.

I would therefore suggest that boilers of boats should be constructed *without internal flues*, as one great preventive of explosions; and that so long as they are used, those boats which have but one or two large boilers, should have at least twelve inches of water over their flues, *when on a level*, the *lowest* gauge cock being that distance above their upper surfaces, and that the form of the flue should be cylindrical.

* See Franklin Journal vol. iii. p. 413, 421. 1827.

Gauge cocks over *each* flue, would also be advantageous, that when the flue on one side of a boiler is depressed by the lurching of a boat, it may be known whether those on the other side are covered by water or not.

2nd. Excess of steam.—It is obvious that this is one of the principal causes of explosions. Against it no boiler can of itself be secure, however strong its materials and unexceptionable its workmanship. Although it is not always the primary cause of explosions, yet it is almost always the active or direct one. When a deficiency of water is the first cause, an excess of steam is frequently created by the exposed part of either boiler or flues being suddenly brought in contact with the water; the consequent rapid accumulation of steam rends the boiler. The escape of the steam by the safety valve in such cases is out of the question, as it is generally loaded far beyond the proper weight, and the amount of that load perfectly unknown; hence no way of escape is left, unless by the gauge, where it is as effectually stopt, since the column of mercury opposed to it, when pressed into one arm of the gauge, would probably exceed the pressure necessary to rend the boiler. Besides, its capacity for such a purpose would be perfectly insignificant.

The common safety valve, though expressly designed to prevent an excess of steam, is universally admitted to be defective; and yet upon it chiefly depends the safety of the boiler, the boat, and the passengers. The defects of the valve, and of the mode of obtaining the pressure upon it, are still further increased by the *stuffing box* through which the valve rod passes: supposing every other part perfect, what accuracy can be obtained in the amount of pressure on a valve, while this injurious appendage is continued?

But the most obvious defect of the common safety valve, is, that it may be loaded indefinitely at the pleasure of the attendants, and this is now so generally done, that it is of little more use than a common cock of the same diameter would be. It is generally opened and closed by a cord attached to it for that purpose, according to the tension of the steam indicated by the gauge; so that instead of being left wholly to the action of the steam, when raised to a certain pressure, its action is made to depend on the attention of the engineer! and he again is guided by the gauge! Under such circumstances we are warranted in asserting that a cock would be a substitute equally effective.

Were it not for the mercurial gauges used in boats, no accurate knowledge of the pressure of steam could be ascertained by safety valves as ordinarily used.

Of the numerous devices for preventing an excess of steam, perhaps none is of more importance than "legislative enactment," to regulate and limit the pressure of steam in boats carrying passengers, according to the material, form and internal diameter of their boilers. The strength of the boilers to be frequently tested, and the force of steam regulated accordingly. There can be no possible security for the lives of passengers in steam-boats, however strong their boilers may be, so long as the elastic force of steam in them can be increased in-

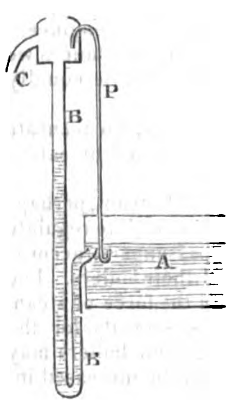
definitely, either through temerity, ignorance, intemperance, caprice, or a spirit of rivalry in contests of speed with other boats.

Of mechanical devices, perhaps the most simple and effective is, to balance the pressure by a column of water in a tube placed perpendicularly through the top of a boiler, as is often done in the low pressure boilers of stationary engines. It is one of the surest safeguards from an excess of steam, and also makes known a deficiency of water. Its introduction into steam-boats has been recently recommended by R. V. Dewitt, Esq. of Albany.

The greatest defect in this safety pipe is, that when the steam has overcome the resistance of the column, all the water above the mouth of the pipe in the boiler is blown out; neither can it be replaced until some time after the steam has been permitted to escape, since it would be blown up the tube as fast as injected by the pump. In many situations, boats with such an apparatus, would be nearly in as great jeopardy from the *want* of steam, as from the rupture of their boilers by its *excess*. The mouth of the pipe would be liable to be uncovered at times by the motion of the boat, and the inconvenient height to which the pipe would have to be carried, if applied to boilers containing steam from twenty to twenty-five pounds, is another objection. Notwithstanding, it *has been* applied to steam boats. The "Macdonough," on Lake Champlain, (as I am informed by a gentleman of this city,) had one of these safety pipes put to her boiler in 1828, which has been continued in use to the present time: its height above the boiler is about twenty feet. This boat runs from St. Albans to Plattsburgh.

It would seem difficult to derange this simple apparatus either by negligence or design; yet, in a contest of speed between the Macdonough and another boat, this very pipe was *plugged up* at the top! Several feet were added to its length afterwards.

If used at all in boats, its height ought certainly to exceed every other part by several feet, to prevent the possibility of its being closed in the manner just mentioned.



The annexed figure is designed to show how some of its defects may be avoided. A, is part of a boiler. The perpendicular height of the small pipe, P, is to be regulated to the maximum pressure of steam intended to be used. B, B, is the "safety pipe." It is continued down as far as convenient *below* the boiler, before it ascends. When the steam rises above its prescribed force, it will expel the water from P *first*, and so *give notice* to the attendants. Should the warning be neglected, both water and steam would soon be driven out of B, B. C, is to convey the hot water down. The water expelled from P falls into the head of B, B, and again descends into the boiler. It would be difficult to plug the upper end of B, B, if of the form represented in the diagram, as the end of C would also have

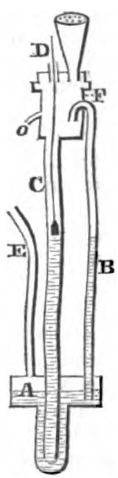
to be closed, before the steam could be improperly increased. B, B, should be *at least* six feet longer than P.

As a further security against an excess of steam, I have made an addition to the mercurial gauge, by which it will give notice of the excess; and also act (in the proportion of its internal diameter,) as an additional safety valve.

The common gauge is of itself no security against an excess of steam, any further than as it presents to the eye of the attendants an index of its elastic force.

Steam *may* be raised to a dangerous degree without being detected, and very frequently is so: an example is given in the 5th volume of the Journal of the Institute, p. 355. There are not wanting instances where the gauge has been plugged up, like the safety pipe in the "Macdonough" just mentioned.

The common gauge is adapted to the eye only, and it requires a constant examination. With the improvement I have added it addresses itself to the hearing also of all on board. The steam *cannot* exceed its limited pressure without giving instant notice, and it can *only* be silenced by decreasing that pressure. Its form may be that of the ordinary gauge, but the one I use is similar to that figured.



A, is an iron vessel to contain the mercury: in the centre of its bottom is a tube ten or twelve inches long, cast on it and its lower end closed.

B, is a tube whose length is equivalent to the pressure required.

C, is a tube in which a float acts. D, is the float.

E, the steam pipe.

F, another vessel to receive the mercury when expelled from B.

O, a small pipe to carry off the condensed steam.—(Water remains in F as high as O; it serves to prevent the mercury from being thrown about when forced out of B.)

The action of this gauge cock will be obvious. When mercury is poured into F, it will run down into A. Suppose A is two-thirds full, and steam admitted through E, then the mercury will be pressed up B and C, and if the steam increases above its prescribed force it will be driven out at B, when it again enters A through C.

The pipe C should be ten or twelve inches longer than B.

The action of this gauge is similar to that of the warning pipe described in last page, and which was suggested by the use of this.

Were steam boats provided with gauges of this description, (the length of the pipe B being regulated to the maximum pressure,) any attempt to exceed it would be defeated and made known; and as in the last figure, if the notice thus given, be not attended to, the whole of the mercury would soon be expelled out of A through C.

This gauge also answers every purpose of the common one.

[TO BE CONTINUED.]

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, *to ascertain, by experiment, the value of Water as a Moving Power.*

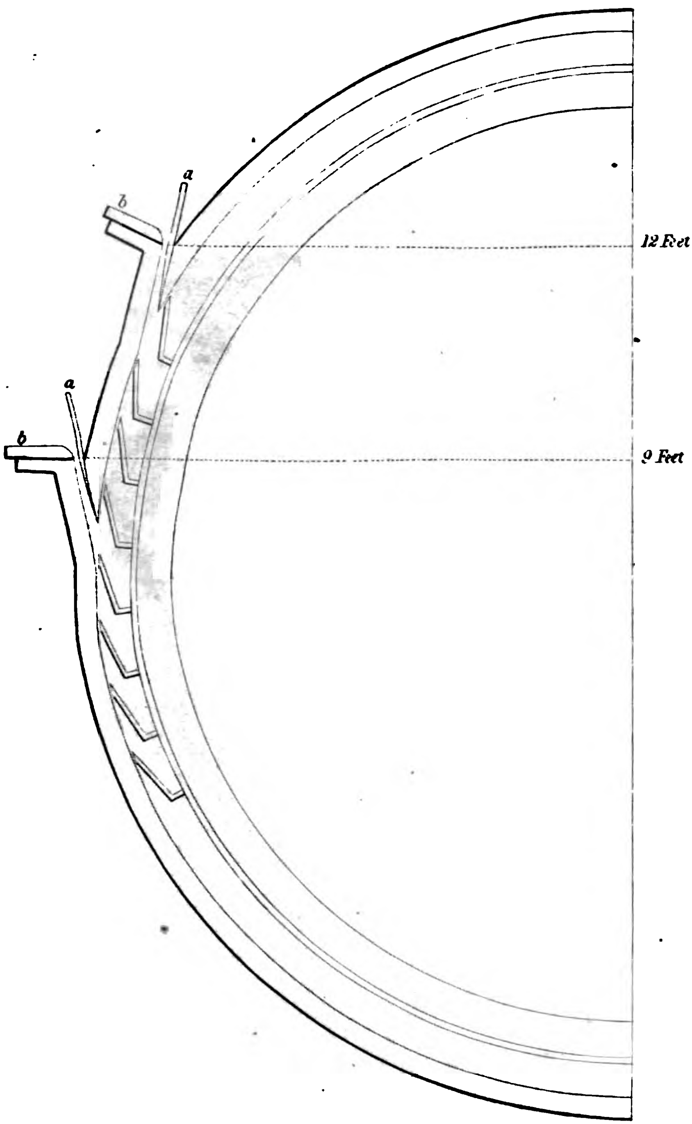
(Continued from p. 303.)

The tables which follow, (viz. e and f,) exhibit the results of a series of experiments made with wheel No. II, to ascertain the different areas of aperture, and quantities of water, required to raise a determinate weight through a given height in a determinate time, with a head and fall of fifteen feet, and of twelve feet, and with intermediate heights of water applied at the same or at different points above the bottom of the wheel. Thus to determine the comparative value of water when employed under the several circumstances embraced in the series.

The two chutes used will be designated as A and B. Each was two inches in width by sixteen inches in breadth, and delivered the water in the same direction with regard to the periphery of the wheel. To each of these chutes was applied the arrangement of gates figured on Plate V. A gate capable of sliding upward is represented at *a*, and at *b* a false gate which could be drawn back until its front edge was even with the back of the chute; beyond this position the gate was prevented from being drawn by a permanent stop. Between the front edge of the gate *b* and the face of *a* the water passed. By moving the gate *b* forward, against *a*, the aperture was closed. The gate *a* was twenty-two inches long, one inch and a fourth thick, and at a line eleven inches from the upper end began to taper, terminating in an edge at the lower end. By lowering or raising this gate the aperture was diminished or increased. In any position in which *a* was placed, the false gate *b* could be moved forward against its face so as to close the aperture. The false gate *b* was two inches thick, the face being rounded so as to leave the smallest part of the opening at its lower edge, at which place the aperture was measured. This line was also taken as that from which to make the division into head and fall: when the gates *a* and *b* were applied at chute A, this line was twelve feet above the bottom of the wheel, and nine feet above the same point when the gates were attached to chute B.

The gates just described having been adapted to chute A, the gate *a* was opened so as to give an area of aperture of fourteen inches; in this position it was secured by screws to prevent the possibility of variation in the aperture by a movement of the gate. The false gate *b* having been also placed, the water in the forebay was raised to the height of three feet above the aperture, making a head and fall of fifteen feet. A series of experiments were then made to ascertain what velocity of the wheel would give a maximum of effect with the assumed area of aperture and head and fall, the weights being varied for this purpose.

The result was, that the maximum effect was obtained with a ve-



Scale $\frac{1}{8}$ of an inch to a foot.

locity corresponding to 36.75 seconds, and a weight raised of 706 lbs. the height through which the weight was raised being forty feet.

With this weight, aperture, and head and fall, ten experiments were made, the velocity in each being regulated as nearly as possible to correspond to 36.75 seconds; the time in each case being recorded. The head was then changed by three inches at a time until within one and three-fourths feet of the aperture. At each change of head the size of the aperture was adjusted by trial, so as to raise the weight forty feet high in a time as near to 36.75 seconds as was practicable. The proper size of the aperture having been thus found, the gate *a* was secured as before described, and ten experiments made.

The results of the different experiments with chute A are given in table e. To have determined the velocity necessary to produce a maximum effect under each head, would have added very much to the labour of the experiments. The conclusions will show the method by which the knowledge derived from the other experiments can be applied to these cases, in which instead of the precise weight and velocity appropriate to the maximum effect for the head and fall in question, those for a fifteen feet head and fall are used.

To avoid any difference in the form or dimensions of the gates applied to chute B and to A, the gates used at the former were transferred to the latter chute. Experiments similar to those described as made at chute A were then gone through, the heads above the gate being varied from six feet to two by one foot at each series. Table f contains the results of the fifty experiments made at this chute.

Table e.—Part I.

Wheel No. II.—Chute A.—*Bottom of gate 12 feet above bottom of wheel.*

No. of Exper't.	Head above gate.	Fall below gate.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Observations.
	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.				
1	3.00	12.00	0.66	706	32.18	738.18	40.0	36½	7.76	2930	15.00	439500	295272	.672	
2								36	7.87	2925		438750		.673	
3								36½	7.76	2945		441750		.668	
4								35½	8.00	2935		440250		.671	
5								35½	8.00	2920		438000		.674	
6								36	7.87	2915		437250		.675	
7								37	7.65	2925		438750		.673	
8								37	7.65	2920		438000		.674	
9								37	7.65	2925		438750		.673	
10								37½	7.55	2930		439500		.672	
11	2.75	12.00	1.00	706	32.18	738.18	40.0	37	7.65	2925	14.75	431437	295272	.684	
12								36½	7.76	2915		429962		.687	
13								37	7.65	2925		431437		.684	
14								37	7.65	2930		432175		.683	
15								37	7.65	2925		431437		.684	
16								37	7.65	2945		434387		.680	
17								36½	7.76	2930		432175		.683	
18								37	7.65	2925		431437		.684	
19								36½	7.76	2930		432175		.683	
20								37	7.65	2920		430700		.685	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

TABLE e.—PART II.

WHEEL NO. II.—CHUTE A. *Bottom of gate 12 feet above bottom of wheel.*

No. of Exper't.	Head above gate.	Fall below gate.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Observations.
	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.				
21	2.50	12.00	1.07	706	32.18	738.18	40.0	36½	7.76	2945	14.50	427025	295272	.691	
22								36½	7.76	2950		427750		.690	
23								36½	7.76	2960		429200		.687	
24								36½	7.76	2950		427750		.690	
25								36½	7.76	2945		427025		.691	
26								36½	7.76	2930		424850		.695	
27								36½	7.76	2945		427025		.691	
28								37	7.65	2940		426300		.692	
29								37	7.65	2950		427750		.690	
30								36½	7.76	2950		427750		.690	
31	2.25	12.00	1.12	706	32.18	738.18	40.0	36½	7.76	2965	14.25	422512	295272	.698	
32								37	7.65	2970		423225		.697	
33								37	7.65	2950		420375		.702	
34								36½	7.76	2975		423937		.696	
35								37	7.65	2960		421800		.700	
36								37	7.65	2955		421087		.701	
37								37	7.65	2960		421800		.700	
38								37	7.65	2970		423225		.697	
39								36½	7.76	2970		423225		.697	
40								37	7.65	2980		424650		.695	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

TABLE e.—PART III.

WHEEL No. II.—CHUTE A.—*Bottom of Gate 12 feet above bottom of Wheel.*

No. of Exper't.	Head above gate.	Fall below gate.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Observations.
	Feet.	Feet.	In.	Pds.	Pds.	Pounds.	Feet.	Secs.	Feet.	Pds.	Feet.				
41	2.00	12.00	1.18	706	32.18	738.18	40.0	36½	7.76	2980	14.00	417200	295272	.707	
42								36½	7.76	3005		420700		.701	
43								37	7.65	2980		417200		.707	
44								37	7.65	3005		420700		.701	
45								36½	7.76	2980		417200		.707	
46								36½	7.76	3000		420000		.703	
47								37	7.65	3015		422100		.699	
48								36	7.87	2995		419300		.704	
49								36½	7.76	3010		421400		.700	
50								36½	7.76	3000		420000		.703	
51	1.75	12.00	1.27	706	32.18	738.18	40.0	36½	7.76	3035	13.75	417312	295272	.707	
52								37	7.65	3040		418000		.706	
53								37	7.65	3035		417312		.707	
54								36½	7.76	3025		415937		.709	
55								37	7.65	3035		417312		.707	
56								37	7.65	3025		415937		.709	
57								37	7.65	3035		417312		.707	
58								37	7.65	3050		419375		.704	
59								37	7.65	3030		416625		.708	
60								37	7.65	3030		416625	*	.708	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

* The aperture was next increased to two inches, but the quantity of water delivered was too great for the wheel to receive: the water splashing much, accompanied by the noise usual in such cases. The ratio of effect to power has always been found to diminish in similar cases, and did so in this.

TABLE f.—PART I.

WHEEL NO. II.—CHUTE B.—*Bottom of gate* 9 *feet above bottom of wheel.*

No. of Exper't.	Head above gate.	Fall below gate.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Observations.
	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.				
1	6.00	9.00	0.78	706	32.18	738.18	40.0	37	7.65	3660	15.00	54900	295272	.538	
2								36½	7.76	3675		55125		.535	
3								36½	7.76	3655		54855		.538	
4								36	7.87	3635		54525		.541	
5								37	7.65	3655		54855		.538	
6								36½	7.76	3655		54855		.538	
7								36½	7.76	3620		54300		.543	
8								36½	7.76	3645		54725		.539	
9								37	7.65	3640		54600		.540	
10								37	7.65	3650		54750		.539	
11	5.00	9.00	0.87	706	32.18	738.18	40.0	36¼	7.71	3690	14.00	51660	295272	.571	
12								37	7.65	3700		51800		.570	
13								36½	7.76	3690		51660		.571	
14								36½	7.76	3710		51940		.568	
15								37	7.65	3700		51800		.570	
16								37	7.65	3705		51870		.569	
17								37	7.65	3700		51800		.570	
18								36½	7.76	3685		51590		.572	
19								36¼	7.81	3680		51520		.573	
20								36½	7.76	3690		51660		.571	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

TABLE f.—PART II.

WHEEL No. II.—CHUTE B.—*Bottom of gate 12 feet above bottom of wheel.*

No. of Exper't.	Head above gate.	Fall below gate.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Observations.
	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.				
21	4.00	9.00	0.97	706	32.18	738.18	40.0	37	7.65	3810	13.00	49530	295272	.596	
22								37	7.65	3790		49270		.599	
23								37	7.65	3800		49400		.597	
24								37	7.65	3800		49400		.597	
25								37	7.65	3800		49400		.597	
26								37	7.65	3755		48815		.605	
27								37	7.65	3800		49400		.597	
28								37	7.65	3805		49465		.596	
29								36½	7.76	3785		49205		.600	
30								37	7.65	3800		49400		.597	
31	3.00	9.00	1.11	706	32.18	738.18	40.0	36½	7.76	3980	12.00	47760	295272	.618	
32								36½	7.76	3975		47700		.619	
33								37	7.65	3975		47700		.619	
34								37	7.65	3960		47520		.621	
35								36½	7.76	3970		47640		.619	
36								37	7.65	3970		47640		.619	
37								37	7.65	3980		47760		.618	
38								37	7.65	3985		47820		.617	
39								37	7,65	3980		47760		.618	
40								37	7.65	3980		47760		.618	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

TABLE f.—PART III.

WHEEL NO. II.—CHUTE B.—*Bottom of gate 12 feet above bottom of wheel.*

No. of Exper't.	Head above gate.	Fall below gate.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Observations.
	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.				
41	2.00	9.00	1.5	706	32.18	738.18	40.0	37	7.65	4270	11.00	46970	295272	.628	
42								37	7.65	4280		47080		.627	
43								36	7.87	4265		46915		.629	
44								36½	7.76	4285		47135		.626	
45								37	7.65	4270		46970		.628	
46								36¾	7.71	4300		47300		.624	
47								36½	7.76	4300		47300		.624	
48								37	7.65	4290		47190		.625	
49								37	7.65	4280		47080		.627	
50								36½	7.76	4290		47190		.625	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

Bibliographical Notices and Reviews.

Practical Essay on the Strength of Cast Iron, and other Metals, &c. &c. by Thomas Tredgold, Civil Engineer, &c. Third edition, improved and enlarged: London, 1831.*

This is a posthumous edition of the valuable work of Tredgold on the strength of iron. We are told in the advertisement that the work has been printed from a copy of the second edition, corrected by the author, and that the publication has been superintended by Professor Barlow, of Woolwich. The new edition is essentially the same with the second; the additions, as far as we have been able to detect them by examination, consist of seven notes, of different degrees of importance, by the author, and one by the editor. From the latter note by the editor we learn that the hope expressed by Mr. Tredgold of being able to resume his experiments upon the effect of impulsive force upon iron, had not been realized.

Tredgold presents a fine example of what may be accomplished by persevering industry, even under the disadvantages of want of early education. His works attest the extent of his labours. As given in the advertisement to the work which we have noticed, they are as follow: Elementary Principles of Carpentry, 4to. Treatise on Joinery, (Encyc. Britannica.) Essay on the strength of Cast Iron and other metals, 8vo. Additions to Buchanan's Essays on Mill Work, 2 vols. 8vo. Treatise on Stone Masonry, (Supp. Encyc. Brit.) Principles of Warming and Ventilating Public Buildings, &c. 8vo. Treatise on Rail-roads and Carriages, &c. Letter to Mr. Huskisson on Steam Navigation, 8vo. Additions and Notes to Tracts on Hydraulics, by Smeaton, &c. 8vo. Practical Rules with Diagrams for Barlow's Essay on the Strength of Timber, 8vo. The Steam Engine, comprising an Account of its Invention. Progressive Improvement, &c. 4to.

B.

A Treatise on the Strength and Dimensions of Cast Iron Beams, when exposed to transverse strains from pressure or weight: with a Table of Constants, to be used for calculating the strength and dimensions of similar Beams of Wrought Iron, &c. &c. To which is added the Theory of Bramah's Hydro-Mechanical Press. By William Turnbull. London 1831. 8vo. pp. 86.*

This is a *manufactured* work on the strength of materials. The process being as follows.. Tredgold's formulæ for the ultimate strength of beams are taken; the constant multipliers from experiment, for the greatest weights borne by the material without impairing the elas-

* Com. Pub.

ticity substituted for the multipliers for ultimate strength, and the formulæ assumed to represent truly the weights which can be borne by different beams without injuring their elasticity. Thus are made out the first fifty-seven pages, entitled "Transverse Strain."

The next chapter treats of "deflection and stiffness." The first being transcribed from Tredgold, and the second altered from the same author by both subtraction and addition.

The discussion of the theory of Bramah's press, which follows, is wrapped up in equations giving an appearance of difficulty to the calculations relating to it. As a specimen of analysis this theory is not more to be commended, since of the four proportions said to contain the theory, two only are essential, the other two being derivatives. The third, by composition of the first and second, and the fourth by inversion from the second.

The author has placed himself above criticism in his preface, by assuring that he submits his work "to the public eye, indifferent alike to censure or applause—he fears not the one, he courts not the other."

B.

On the Strength and Best Forms of Cast Iron Beams.

[Continued from p. 336.]

Under the patronage of the same liberal proprietors at whose expense the experiments already given were made, our author was enabled to add to the value of his results by a third series, in which the dimensions of the beams were varied considerably: we give the remarks introductory to this third series, with the details of the first experiments.

"The beams were in this instance cast on their side in the manner of those in the first six experiments on beams; it being rather more convenient to cast them so than erect, as has been usually done in the others. The intention of these experiments would perhaps be understood by first taking the three marked 28, 29, 30, and then the next three. I will, however give the following explanation.

"In experiment 28, the model from which the beam was cast was that of experiments 19 and 20, with the bottom rib still further increased; the vertical part of the beam, or that between the flanges, being rendered a little thicker, and tapering upwards from the bottom flange. This was done to endeavour to prevent fracture taking place, by a wedge tearing out from near the neutral line, as was the case in experiment 19.

"In experiment 29, the model of the beam had precisely the same section in its middle as that in experiment 28; but the beam was twice the length. If then the strength be inversely as the length, this beam ought to bear half of that in experiment 28.

"In experiment 30 the model had in its middle section, the same top and bottom rib, as in the two preceding experiments, with nearly the same thickness of vertical part; but this beam was double

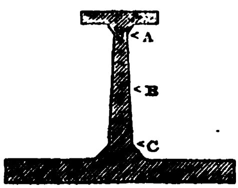
the depth of the others; it was likewise double the length of that in expt. 28, and had therefore the same length as that in experiment 29. If then the strength be simply as the depth, as we have before concluded, (article 57,) this beam ought to have double the strength of that in experiment 29; and if the strength with the same section be inversely as the length, its strength should be the same as that in experiment 28, it being double the length and depth, and in other respects the same.

"The remarks above made respecting experiments 28, 29, and 30, will equally apply to experiments 31, 32, and 33, these having been made with the same view, and only differing from the beams in the preceding ones, by having a larger bottom rib.

"60. All the beams, (except those of the common form,) were made like those described after experiment 13; with this difference, however, the parabola of the bottom rib was, in the 4 ft. 6 ins. beams, three inches longer than the distance between the supports, viz. 4 ft. 9 ins., and in the nine feet beams, six inches longer, or nine feet six inches, this was done to render the ends of the beams a little stronger, agreeably to the remarks made prior to experiment 23.

XXVIII. EXPERIMENT.

"Distance between supports 4 feet 6 inches.
Depth of beam, $5\frac{1}{8}$ inches.
Weight of beam, 81 lbs.



Dimensions of section in inches.

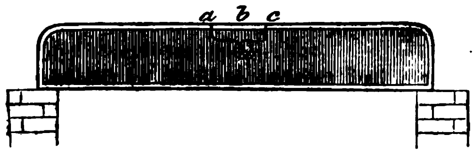
Area of top rib $2.15 \times .27 = .58$
,, bottom ,, $6.74 \times .71 = 4.785$
Thickness at A - - .25
,, at B (half way between flanges) .37
,, at C - - .53

Area of section 7.20 inches.

Weight in lbs.	Deflections in parts of an inch.	Returned to, (weights taken off.)
11056	.19	0
11746	.20	0
12436	.23	+
13126	.24	+
13816	.25	.03
14506	.27	.03
15196	.29	.04
15886	.31	
16576	.32	
18592	.36	
19600	.40	
20608	.42	
21616	.45	

22624	.49	.13
23128	.50	
23632	.52	
24136	.53	
24640	.55	

25144 with this it broke. It is doubtful whether by tension or compression, a crack showing a wedge which *broke out afterwards*, and of which *a b c d* is the form.



a c = length of wedge = 4.2 inches.
b d = depth of wedge = 1.7 „
25144 lbs. = 11 tons $4\frac{1}{4}$ cwt. = breaking weight.
Hence strength per square inch of section = $\frac{25144}{7.2}$ = 3492 lbs.

"To compare this with the results from the common beam, we will take the mean between those in experiments 4 and 34, they being both supposed to be from the same sort of iron, and the only ones that were cast on their sides. Experiment 4 gave 2584 lbs., and experiment 31, 3009 lbs. per inch: mean = 2796.

$\therefore$ 3492 — 2796 = 696 = excess.

"Hence saving in metal, from section, = $\frac{696}{3492}$ = $\frac{1}{5}$ nearly.

"If we compare this beam, by weight, with the mean weights derived from experiments 4 and 34, since in the former $40\frac{1}{2}$ lbs. bore 8270, and in the latter $36\frac{1}{2}$ bore 8792; taking the sums, 77 lbs. bore 17062 lbs.

"$\therefore$ 77 : 81 lbs. (the weight of this beam) : : 17062 : 17948 lbs. = weight it should have borne; but it did bear 25144, $\therefore$ 25144 — 17948 = 7196 = excess.

"Hence saving in metal from section and ends = $\frac{7196}{25144}$ = .286.

Experiment 29. Imperfect from defects in the casting.

Experiment 30. Distance between the supports nine feet. Depth of the beam $10\frac{1}{4}$ inches. Weight 227 lbs. 28672 lbs. broke this beam, by compression, exactly in the middle. A wedge similar to that in experiment 28, but larger, was broken out. The dimensions of the wedge were *ac*, (see figure to experiment 28,) 13 inches, *bd* 5.8 inches.

Experiment 31. Distance between the supports $4\frac{1}{2}$ feet. Depth of beam 5.1 inches. Weight 88 lbs. Area of top rib .52, of bottom 5.472 square inches. Elasticity impaired by 12777 lbs. Broken by tension in the middle by 28168 lbs. Strength 3565 lbs. This presents a saving in metal over the common beam of .215 lbs. derived

from the section, and the ends included, of .307, or more than $\frac{3}{10}$ths of the weight of metal.

Experiment 32. Distance between the supports nine feet. Depth of beam $5\frac{1}{8}$ inches. Weight 192 lbs. Intended to compare with the beam of experiment 28. Broken by 15196 lbs., throwing out a wedge as in figure second to experiment 28; ac = 6.9 inches, bd = 2.25 inches.

Experiment 33. Distance between the supports and depth as in experiment 30. Area of bottom rib increased from 4.72 to 5.70 sq. inches. Elasticity impaired by 19600 lbs. Beam broken by 32200 lbs. A wedge separated.

"61. The beam had twisted a little, by the last two or three weights, in a serpentine manner through its whole length, which shows that in so deep and thin a beam, the top rib (2.2 inches broad in the middle, and tapering to about half that width near the ends,) was as narrow as was admissible to support the beam."

Experiment 34. A *common beam* from the same model as that beam used in experiment 4 but cast upon its side for the sake of comparison. Weight $36\frac{1}{4}$ lbs. Elasticity impaired by 4838 lbs. Strength 3009 lbs. per square inch. This beam, and that of experiment 4, both cast upon the side, give 2796 lbs. as the mean strength of this form thus cast.

Experiment 36. A beam of the *common form* from the same model and iron as in the last experiment, but cast *erect*. Weight 37 lbs. Elasticity impaired by 4493 lbs. Broken by tension, with 9044 lbs. Strength 3188 lbs. per square inch of section.

"62. In the preceding experiments, there ought, according to supposition, (art. 59,) to have been an equality of strength between the beams in experiments 28 and 30, and those in 31 and 33; there was, however, a difference in both cases, of about one-eighth of what the larger beam bore, that beam being the stronger.

"Experiment 29 was defective, but experiment 32, where the object was the same, and which ought to have given a strength equal to half that in experiment 31 or 33, indicated, as it ought, a breaking weight whose double was somewhere between what was given by them. The discrepancies in the strength of the beams in the four experiments first named above, are considerable; but not so great as to render it necessary to seek for any other law. They may, moreover, perhaps, be accounted for by the ways in which the fractures took place; three out of the four beams having broke by the separation of a wedge, and consequently by the rupture of a part whose strength was not so well proportioned as that of the bottom rib, which must have been torn asunder first, if the beams had broke by tension.

"The superior thickness of the vertical part near the bottom rib prevented, as was intended, the fracture taking place as in experiment 19, by the breaking out of a wedge near the neutral line; but

it was only that, as in experiment 28, a wedge of a less size, and of the same form, might break out higher up, where the vertical part was thinner. It seems then probable, from these experiments, that no advantage would accrue from making the vertical part of unequal thickness.

Comparing the weights of the beams in experiments 32 and 33, with the loads they bore, we see that a great increase of strength may be obtained through a small additional weight of metal, when the depth can be increased.* This circumstance which was shown too by experiments 23 and 26, will enhance the value of the latter, and of experiments 30 and 33; especially as they are on a larger scale than any other we have made. We have not in these experiments been able to crush the top rib of the beam, though in both 30 and 33, the bottom rib was to the top one in a higher proportion than had been used in experiment 19, or in either of the former series of experiments; the ratio in experiment 33, being nearly that of eight to one. The bottom rib, in both instances, was rather too large for the thickness of the vertical part, as was evident from that part having failed the first. To have made the section then of equal strength every where, and consequently to have disposed the metal in the most economical manner possible, (which has been our principal view in these inquiries,) the vertical part of the beams should have been rendered a little thicker; and, as we have just seen, perhaps, made uniform. The top rib too, small as it was, would in both instances, possibly, have borne a reduction, only that it would have rendered the beam liable to have twisted; a tendency which showed itself in both experiments.

"From these experiments, and those commencing with 23, it is evident that, with a given top and bottom rib and thickness of vertical part, we may often beneficially increase the depth of a beam, and that to a considerable extent; but doubtless, though we have had no experiments suitable to show it, a less thickness of vertical part would have been required, if the depth of the beam were reduced, its length remaining the same. This matter has been touched on in article 33, (see also Robison's Mechanical Philosophy, vol. i. article 390,) and the experiments will throw additional light upon it; but its further consideration must be deferred to some future opportunity.

"These experiments show clearly, too, that in some of our earliest experiments, the weakness of the beams, considering the quantity of section, arose principally from the vertical part being too thick.

"Before concluding these remarks, I may further mention, that in all cases where the beam has broken by the separation of a wedge, as

"* It is not always adviseable to increase the depth of a beam, when we have the means of doing it, as it would lessen its flexibility, and render it liable to be broken by percussion, through weights falling upon it. Some experiments on the resistance of beams to impulsive forces, which I commenced on a large scale some time ago, through the liberal views of Messrs. Fairbairn and Lillie, may, probably, in an extended form, be offered at some future period to the public.

in the preceding experiments, its vertical part should be rendered a little stronger, so as just to cause it to break by tension, to which case only, the following rules for the strength will properly apply."

We may consider the second part of our author's task completed, and the best form of cast iron beams obtained as the result of his experimental investigation; the successful termination of which he manifestly owes so much to his judicious theoretical views.

The formulæ which he has deduced from his theory apply while the elasticity of the material is perfect, and we are disposed to regret that their results are not placed within the reach of the practical man in so useful a case. The results drawn from the experiments, and having reference to ultimate strength, we proceed to place before the reader. This purpose will be facilitated by collecting the results of the experiments into tables, for the sake of comparison: the plan of the author in stating each experiment separately was pursued in our detail of his labours that his remarks might appear in place.

In the deductions appended to each experiment, comparison was made of the new form with some particular beam of the common form, the early experiments with that of No. 4, which afterwards proved to be deficient in strength compared with other beams of the same form, one of which (No. 34) was cast on its side as well as No. 4. A fairer mode of comparing would be to take *mean* results. That this applies notwithstanding the differences of iron used will appear by comparing the results for different beams cast at different times with those cast at the same time. Proceeding upon this plan, we find for the strength of a beam of the *common form*, cast on its side, 2796 lbs. per square inch.

For a similar beam cast erect (mean of Nos. 10, 13, 17, 22 and 35) we have a strength of 2769 lbs. A result not differing essentially from that just given.

The mean strength of a beam of the *common form* may then be taken at 2782 lbs.

In the table which follows is presented the relative strengths of the different forms of beams experimented upon by the author, the strength 2782 lbs., being taken as unity. Experiments considered by the author to be imperfect are omitted. The series embraces all the experiments made with beams of $5\frac{1}{8}$ inches depth, and $4\frac{1}{2}$ feet bearing length. The first series includes the beams with an elliptical top rib and straight bottom rib, the second those in which the top rib was nearly uniform, and the bottom rib parabolic: these forms were described pages 266 and 326. The modes of casting will be found page 267, and are referred to by the terms there explained.

In order to show the relative *economy* of the different forms of beams, the weight must be considered. The average weight of the two beams of the *common form*, cast on their sides, was 38.5 lbs. Of the five cast erect, 39.5. Average weight of the whole 39 lbs. The value of any form in relation to economy of material, will be in direct proportion to the weight which it will bear, and in the inverse

proportion of the weight of the beam. The economy in reference to any other form will be found by taking the compound ratio of their breaking weights divided by the weights of the beams.

The average weight borne by the seven beams of the common form was 8634 lbs. the average weight of the beams 39 lbs.; 8634 divided by 39 or 221.4 will denote the value of this form in an economical point of view. This we shall take as the term of comparison in the table, calling it unity.

As the author's plan consisted in increasing the bottom rib by degrees, and only adding to the top rib when the compression required it, we shall give the ratio of the bottom to the top rib, considering the latter as unity. Thus in the table, experiment No. 3, we find in the fourth line of the second column 4; this would read, the area of the bottom rib to that of the top rib in the proportion of 4 to 1.

No. of exper't.	Ratio of bottom to top rib.	Relative strength per sq. inch.	Measure of economy.	Form and mode of casting.		
Mean		1.00	1.00	Common form.		
1	1	0.86	0.83	Elliptic top rib.	Cast on side.	
2	2	0.92	0.85	Do.	Do.	
3	4	0.98	0.93	Do.	Do.	
8	4	0.97	0.94	Do.	Cast erect, not inverted.	
9	$4\frac{1}{2}$	1.15	1.09	Do.	Cast erect, inverted.	
11	$4\frac{1}{2}$	1.16	1.15	Do.	Do.	Do.
12	$5\frac{1}{6}$	1.21	1.12	Do.	Do.	Do.
21	$6\frac{3}{4}$	1.27	1.31	Do.	Do.	Do.
*14	$3\frac{1}{4}$	1.17		Bottom rib parabolic.	Cast erect,	inverted.
*15	$4\frac{1}{4}$	1.15		Do.	Do.	Do.
18	$5\frac{1}{2}$	1.19	1.28	Do.	Do.	Do.
19	6	1.47	1.66	Do.	Do.	Do.
20	$6\frac{3}{4}$	1.29	1.40	Do.	Do.	Do.
28	$8\frac{1}{4}$	1.26	1.40	Do.	Do.	Do.
31	$10\frac{1}{2}$	1.28	1.45	Do.	Do.	Do.

In comparing the relative strengths per square inch in the second column, we see that until the lower rib bore to the upper the proportion of 4 to 1, the beams were deficient in strength when compared with the common form. Arrived at this ratio, the form was nearly the same in strength as the common form; the average of experiments 3 and 8 being 0.975, the excess of strength of 14 may be deemed accidental. The new form has then no advantage until the ratio of the ribs exceeds that of 4 to 1. Experiments 1, 2, 3, 8, and 14 may there-

* The weights of numbers 14 and 15 are not given.

fore be omitted in considering the cases in which the new form has advantage over the old.

The advantage of the new form increases with the increase of the lower rib, as is seen from 15, 9, 11, 12, 18, 21, 20, 28, 31; considerably in the increase of the rib from 4 to 6¾, and slowly, if at all, above this point. We cannot but regard the excessive strength of 19, (ratio 6 to 1) as accidental, since the strength of 5½ to 1 is given much lower by experiments 12 and 18, and the strength of 6¾ to 1, given by 21 and 20, is also much lower than that given by 19, while those experiments agree well together.

The saving of metal, given by the third column, keeps pace with the increase of strength of the section. The elliptical form of upper rib, with a straight lower rib, shows its inferiority in this point of view to the parabolic form of lower rib by a comparison of experiments 12 and 18, 21 and 20. The judgment of the author in varying his form in the second series is thus clearly shown.

If the remarks which we have made in reference to the results as to the relative strengths of the different forms be correct, the inferences drawn by the author (and which we are about to present) must be received with limitation. When he asserts that the strength of a beam increases nearly in the ratio of the area of a middle section of the lower rib, we must understand that the limits are on one side the ratio of 4 to 1, and on the other that of 6¾ to 1, in the areas of the bottom and top rib, and that the rule is not general for the new form of beam, but only applies to the more advantageous cases. The rule, it will be seen, is proved by experiments within those limits, and our remarks will show that it cannot safely be applied beyond them. These are, however, the cases which it is most important to consider; since, although it might be convenient to have a certain range through which to vary the size of the lower rib, to adapt it to circumstances, it could not be admissible to depart far from the best form.

The following table, in which the areas of the bottom ribs in experiments 9, 11, 12, 19, 20, and 21, as well as the actual strengths, are compared, will serve to render the author's remarks more intelligible.

No. of experiment.	Area of bottom rib in sq. inches.	Ratio of areas of bottom ribs.	Ratio of breaking weights.	Ratio of bottom to top ribs.
9	1.57	1.00	1.00	4½ a 1
11	2.20	1.40	1.35	"
12	2.89	1.84	1.56	5½ a 1
19	4.40	2.80	2.43	6 a 1
20	4.31	2.75	2.17	6¾ a 1
21	3.31	2.11	1.96	6¾ a 1

The following tables present a comparison of the experiments intended to show the relation between the breaking weights and the lengths and depths.

Distance between the supports 7 feet. Ratio of bottom and top ribs 6 to 1 nearly.

No. of experiment.	Depth of beam in inches.	Ratio of depths.	Ratio of breaking weights.
23	4.10	1.00	1.00
24	5,20	1.27	1.12
26	6.93	1.69	1.64

Distance between the supports and breadth both varied. Ratio of bottom to top rib 6 to 1. Experiment 28 taken as unity.

No. of exper't.	Depth of beam in inches.	Length of beam in feet.	Ratio of depths.	Ratio of lengths.	Ratio of depths divided by lengths.	Ratio of breaking weights.
28	$5\frac{1}{8}$	$4\frac{1}{2}$	1.00	1.00	1.00	1.00
30	$10\frac{1}{4}$	9	2.00	2.00	1.00	1.14
31	5.1	$4\frac{1}{2}$	0.99	1.00	1.01	1.12
32	$5\frac{1}{8}$	9	1.00	2.00	0.50	0.60
33	$10\frac{1}{4}$	9	2.00	2.00	1.00	1.28

"65. Comparing the results of experiments 9, 11, 12, 19, 20 and 21,* and allowing for difference of iron, as indicated by the beams of the common form cast with the others for comparison, I find that the strength is nearly in proportion to the size of the bottom rib or flange: a bottom rib of double size giving nearly, but not quite, double strength. And the subsequent experiments show the strength to be as the depth, every thing else being the same.† Therefore in different beams, whose length is the same, the strength must be as their depths multiplied by the areas of a middle section of their bottom ribs: and where the lengths are different, the strengths will be as this product divided by the lengths."‡§

To find a constant multiplier for this product of the area of the bottom rib by the depth, divided by the length, our author compares together the experiments 12, 15, 18, 19, 20, 21, 23, 24, 26, for beams cast erect, and 28, 29, 30, 31, 32, 33, for beams cast on their sides. The multiplier for beams cast erect is nearly 26, the breaking weight being required in tons, and for beams cast on their sides 25.

In accordance with these remarks we give the following rule, applicable to beams of the new form when the ratio of the bottom to the top rib is between the limits already assigned.

* See table p. 386. † See first table on this page.

‡ See second table on this page.

§ Let "W = the breaking weight in the middle of the beam, a = the area of a section of the bottom rib in the middle of the beam, d = the depth of the beam there, l = the bearing length, and c a constant quantity, W = $\frac{cad}{l}$."

Rule.

Multiply the area of the bottom rib, at the middle of the beam, in inches, by the depth at the same part, also in inches, divide this product by the bearing length in inches.

The quotient thus found, multiplied by 26, will give the weight in tons which will produce fracture if applied at the middle of the beam; the beam having been cast erect.

For a beam cast on its side the quotient found by the first part of the rule, is to be multiplied by 25 to give the breaking weight in tons.

"*Example.*—What weight laid on the middle of one of the main beams, in the rail-road bridge, crossing Water street, Manchester, would be required to break it, supposing it cast erect, and of the same iron we have used; the dimensions from the model now constructing by Messrs. Fairbairn and Lillie being as follow:

"Distance between supports 26 feet, or 312 inches.

"Depth of beam, in middle, $27\frac{1}{2}$ inches.

"Area of section of bottom rib, in middle, $16 \times 3 = 48$ inches.

"Form of section, of beam, nearly the same as in experiment 30."

According to the rule, we multiply the area of the bottom rib in the middle of the beam, 48 inches, by the depth at the same place, $27\frac{1}{2}$ inches, which gives 1320. This product, divided by the bearing length, 312 inches, gives for the quotient 4.23. This quotient multiplied by 26, gives for the weight to produce fracture (109.98, or) 110 tons.

"These beams are intended to bear the same weight in every part; they will not, however, be quite of uniform depth throughout. The load will have to lie upon their bottom rib, through its whole length; it becomes necessary, therefore, to make that rib somewhat broader toward the ends, than according to the parabolic form described after experiment 13; and this enables the depth of the beams, near their ends, to be a little reduced."

The forms determined by our author to be the best, will of course require modification should the weight not be applied in the middle, and the rule must undergo a corresponding change. An example is given by Mr. Hodgkinson of the mode of procedure in such cases. It is that of a beam fastened by one end into a wall, a weight being applied at the other end. Such a beam being only one-fourth as strong as one of equal length to the middle of which a weight is applied to produce fracture, the numbers given by the former rule must be divided by four.

If we would determine the proper form of this beam so that it should be equally strong throughout, we must recur to our rule. By it the weight to produce fracture is proportional to the area of the

bottom rib at the middle section, multiplied by the depth, and divided by the bearing length of the beam. If we consider the strength proportional to the weight to be borne, then the area multiplied by the depth, and divided by the length, must be a constant quantity; that is, the product of the area by the breadth must vary with the length; the greater the distance from the point at which the weight is applied, the greater the product of the area by the breadth must be.

If, for convenience, we cast the beam of a constant depth, then the area of the section must be proportional to the distance from the bearing point, that is, the beam must be triangular, the weight being hung to the vertex.

"In like manner, where the weight is to be applied at the middle of the beam only, the stretched rib, then at the bottom, may be uniformly tapered from the middle to the ends, forming two triangles, instead of the parabolas before employed. In this case, the lines C A and C B* and their correspondent ones on the other side, will be straight.

"75. We might now point out other modifications in beams, and particularly in those of steam engines; which, as appears from the experiments, should have a large equal rib or flange at top and bottom, with, perhaps, a thin solid sheet between them; differing, in the size of the ribs, only, from the form in figure 26, plate 4th of Tredgold's Essay on the Strength of Cast Iron. This is for double engines, but for single ones the beam should have a large rib at top, and a small one at bottom, and be formed like that in the conclusion of the last article. But the further consideration of this matter would extend too far the limits of this paper; it would be well, however, if it were subjected to experiment, as that might tend to a reduction in the mass, and inertia, of these beams."

We have yet one subject through which to follow the author, namely, that of ultimate deflection.

[TO BE CONTINUED.]

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN DECEMBER, 1831.

With Remarks and Exemplifications, by the Editor.

1. For a *Machine for Gathering and Cleansing Fruit*, called the "apple machine;" Elias Ellis, Duxbury, Washington county, Vermont, December 5.

This machine consists of a trough, or spout, which is made in two lengths for the convenience of removal. It is to be placed upon trussels so as to form an inclined plane. The apples are to be drawn by a wooden hoe into a tray placed upon the ground; from this, they are to be poured on to the upper end of the spout, down which the

* See figure p. 326.

sound ones are to run, leaving the dirt, leaves, grass, and unsound apples behind. This is the whole affair.

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2. For *Axletrees, Hubs, and Spokes for Carriages;* Garner Wilkinson, White Creek, Washington county, New York, December 6.

The main object of this patent appears to be the fixing of the axle firmly in the nave or hub of the wheel, with a cylindrical gudgeon, or shaft, projecting out, which is to revolve in metal boxes fixed in that part of the axletree which is attached to the carriage. The apparatus, we are told, may be made of wood, or metal, and the mode of putting it together, in either case, is described; there, however, is no claim made, and as the principal feature is without novelty, we are unable, without further advice, to tell for what the patent is taken.

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3. For a *New mode of Manufacturing Tobacco;* John Allen, jr. and Charles Geoghegan, Richmond, Virginia, aliens, who have resided two years in the United States, December 6.

This improvement in the mode of manufacturing tobacco, will, it is said, save from fifty to seventy per cent. of the labour required by the old mode of making, by hand, plug and twisted tobacco, for chewing.

The lighter kinds of chewing tobacco in which the lumps vary from sixty-four to thirty-two pieces to the pound, are to be spun in the usual way, and then wound upon boards, which may be of such size as will suit the press, say four feet by three. It is then to be pressed flat, and by means of a circular, or a straight, knife, divided into lengths whilst upon the board, and thus prepared of the desired weight and length for packing

The heavier kinds, such as average from six to eighteen to the pound, are to be made into rolls of from six to thirty-six inches in length, which are then to be placed upon the board, pressed, and afterwards divided by the knife.

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4. For an improvement in the *Concave Bed of the Thrashing Machine;* Isaac S. Palmer, city of Philadelphia, December 6.

The cylinder of this machine does not differ from some others; the patent, as the title indicates, being taken for the manner of constructing the concave only. This part is thus described.

"Beneath the cylinder is suspended, on springs, a relief concave bed, which is composed of iron, or of plank, about two inches thick, and forms about one-fourth of the circle of the cylinder. In this concave are fixed a number of thin bars of iron, which are about half of an inch wide, and four inches long, notched on their upper edges, and placed obliquely, so as to point from each side downwards and to the centre; thus the straw will pass much easier, and as it will incline towards the centre of the concave bed, it will be less liable to get between the ends of the cylinder and the sides of the machine, than in machines the bars of which are placed transversely on the concave."

"What I claim as my invention, and wish to have secured by letters patent, is the form of the bars in the concave bed, and the manner in which they are placed."

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5. For a *Fly Net for Horses;* Henry Korn, city of Philadelphia, December 8.

The present patent is taken for improvements of the fly net patented by Mr. Korn on the 12th of September, 1829. It appears that specimens of the improved net are deposited in the patent office, but there is no drawing of it accompanying the specification. One of the specimens is referred to as No. 1, and we are told that the improvement in this part, which is the breast piece, consists in an alteration of the mode of attaching the end straps by buckles round the tug-eyes, &c. Now all this certainly might be represented in, and made clear by, a drawing; and the law absolutely requires it. The improvements, it is said, render the net more durable, more easily used, and more beautiful in its appearance.

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6. For an improvement in the *Plough;* James Carothers, Shirleysburg, Huntingdon county, Pennsylvania, December 10.

The claims made are to the construction of the land side; to grooves in the mould board; to the manner of securing it to the land side; and to what are called regulators.

No particular form is prescribed for the mould board, but it is to be of cast iron, and to be provided with a groove, into which a corresponding part on the land side fits, and secures it in its place. The land side is to be of cast iron, and the angles which it forms with the other parts are particularly described. There are two parts called regulators, one of which is to supply any deficiency in the mould board from wear at the bottom, the other is a screw bolt used in fixing the parts together. This patent, therefore, like most of those taken for ploughs, is mainly for the manner of uniting its parts, and not in the principle of construction.

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7. For a standing press, called the *Toggle Joint Screw Press;* Luke Hall, Hollis, Hillsborough county, New Hampshire, December 12.

In this press there are two toggle joints, which, when the pressure is taken off, recede from each other, and when it is to be exerted, are drawn towards each other until the compound bars of which each toggle joint consists stand in parallel lines. In order to draw them towards each other, the shaft of a strong screw passes through nuts properly fixed in the middle of each toggle joint, this shaft having a right handed screw at one end, and a left handed screw at the other, acts simultaneously on the joints to cause them either to approach or recede. The screw is to be turned by a crank, on the shaft of which there is a pinion taking into a wheel on the screw shaft, and capable therefore of operating upon it with vast power.

The claim is to the application of the right and left handed screw to the toggle joints, all the other parts being common.

The press, as represented, will certainly be a very powerful one, but we apprehend that there are but very few purposes to which it can be applied. The range of its platten will be small, and its action slow; and, for most purposes, these circumstances would entirely neutralize its good properties.

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8. For a *Machine for Hulling and Cleaning Clover Seed;* Alexander Matthews, Island Creek, Jefferson county, Ohio, December 13.

The external form of this machine is nearly the same with that of the wheat fan. The clover to be cleaned is put into a hopper, whence it is drawn by two fluted rollers, and delivered between two fluted rubbing boards, and thence between two cast iron rubbing plates, the contiguous surfaces of which are furnished with numerous fine teeth cast on them. The rubbing apparatus lies horizontally at the upper part of the machine, and below it are two sieves through which the seed and chaff are to pass on to a sloping board, where they are acted upon by a revolving fan. The whole apparatus is arranged on the same principle with several others, for the same purpose, and a claim to it must depend for its validity upon the construction, as specified. The claim is made to "the foregoing machine for the purpose of hulling and cleaning clover seed, or for any similar purpose to which it can be applied."

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9. For a *Washing Machine;* Miles B. Hand, Lockport, Niagara county, New York, December 14.

There are to be two reeded rollers running upon gudgeons in a frame within a trough. The gudgeons of one of the rollers run through the trough, and have a leather strap passing round them, and extending down to a treadle, by placing the foot upon which the roller may be made to revolve. A spring pole above, with a line descending from it, may serve to raise the treadle. The clothes are to pass to and fro between the rollers. The claim is to the using of two rollers only, and to the turning them in the way described.

We do not see any thing in this machine likely to redeem the character of the great family to which it belongs, and which is not in high repute.

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10. For a *Thrashing Machine and Horse Power;* John Lammon, Macedon, Wayne county, New York, December 14.

We are informed by the patentee that the improvement here made in the thrashing machine consists in the form of the teeth of the cylinder and the bed piece; and in allowing these two parts to recede from each other. The teeth are to be tapering, being about three-eighths of an inch in diameter at their lower ends, and terminating in a point. Their length is to be about three-fourths of an inch.

The horse power consists of a band wheel upon a vertical shaft, a strap from which turns a whirl on a second shaft, carrying another

band wheel, the strap of which drives the cylinder of the machine. There may be novelty in each, but we have not discovered it.

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11. For an improvement in the *Horse Shoe;* Lewis T. C. Smith, Scott county, Kentucky, December 15.

The upper side of this shoe is to be perfectly flat for some distance from the outer edge, when it is to be dishing or bevelled. The lower, or tread side, is to be raised to nearly a sharp edge along the groove which receives the nail heads. This is to cause it to take firm hold of the ground, and prevent slipping. These, and certain other points, which are particularized, constitute the claim. "All of which parts," the patentee says, "differ in principle materially, mechanically, and usefully, from any horse shoe known, or believed to be in use," &c.

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12. For an improved *Fire Place and Oven;* Jonathan Knight, Stoddard, Cheshire county, New Hampshire, December 15.

It can scarcely be said that the present patentee has given such a description of his invention as shall "distinguish it from all other things before known or used; nor has he told us what kind of fuel is to be employed in his fire place, we suppose, however, that it is to be wood. The whole description is brief and perfectly general, without any claim, or any mode of expression which indicates the parts or arrangement that he considers as new. We are told that the foundation is to be of brick or stone; that the cap is to be of stone, or iron, with two circular holes in it for boilers, and a niche at the back part of it for heat and smoke to pass. The oven may be either of stone or iron. There must be suitable funnel holes to conduct the smoke from the niche; and a piece of sheet iron is to be placed in front, forming the upper part, or breast, of the fire place.

We have not given the foregoing for the purpose of affording a distinct view of the apparatus, as we do not possess this ourselves, even though aided by the drawing in the attempt to obtain it.

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13. For a *Percussion Cannon Lock;* Samuel Ringgold and John P. Moore, of the city of New York, assignees of the inventor, Enoch Hidden, of the same place, December 16.

Several patents have been obtained for improvements in the percussion lock for cannon. Joshua Shaw, of Philadelphia, Lieut. Bell, of the U. S. army, Mr. Hidden, and Mr. Eastman, of Maine, are among the number of those whose inventions we have noticed. In the petition on the present occasion, it is said that the invention consists in the construction of "a percussion lock which is made to move horizontally, or by a side movement or motion of the cock, so as to admit the explosion from the vent to pass by without injury, and to be perfectly disengaged from the vent, the cannon and lock remaining in perfect security. The cannon, or gun, to be discharged by means of a primer, priming cap, or pellet, made of any of the percussion fulminating mixtures, of any convenient form." And in the specification the claim is made to "the horizontal or side movement or mo-

tion of the cock, to admit the explosion from the vent to pass by without injury to the lock or cannon."

14. For a *Cheese Press;* John Crane, Hanover, Grafton county, New Hampshire, December 17.

This is called the self-pressing-hanging lever cheese press. It is called self-pressing because the power applied is only the weight of the cheese and that of the apparatus within which it is placed. The construction is ingenious, and the press may undoubtedly be made to operate well. There is a frame similar to that of the ordinary standing press, and a second frame is made which fits between the cheeks of the former, is about half its height, and will readily slide up and down within it. When this inner frame is raised, the two levers which operate in pressing the cheese, approach towards a horizontal position, and when the frame is lowered they are so constructed that they approach to a vertical position, and their shorter ends bear upon a board, or follower, placed above the cheese. An accurate description of it cannot be given without a drawing. There is no claim made, and as the whole arrangement is considered new, and we believe correctly so, it was not necessary to make any.

15. For *Machinery for Washing Gold,* called the Rail-way-Car Gold Riddle; Oscar Willis, Burke county, North Carolina, December 21.

A riddle is to be prepared consisting of four pieces of timber which form the sides, and a bottom of sheet iron, which is to be perforated with numerous small holes. This riddle runs upon small wheels, the ways upon which they run forming a double inclined plane. When the auriferous gravel, or earthy matter, is thrown into this riddle, it is to be moved backward and forward by hand, one end of the riddle rising, and the other being depressed as it moves in each direction, in consequence of the inclination of the ways. Water is to be supplied which washes the gold, and other matters, through the holes on to a recipient below, whence it is conducted to a sloping trough, or ripple, with slats across it, which detain the gold, whilst the lighter parts wash over. The whole is claimed with the exception of the ripple. The patentee says that experience has proved the great value of this machine; there is nothing in its appearance, however, which would mark a superiority over several others previously in use.

16. For a *Perpetual Rotary Oven,* for the baking of bread, crackers, &c.; J. L. D. Mathies, for himself, and as the assignee of James Mathies, deceased, Rochester, Monroe county, New York, December 21.

The main feature of this oven consists in giving to its inside the form of a vertical cylinder, with a vertical shaft in its centre, which supports a circular cast iron shelf, fitting the sides of the oven so nearly as but just to clear them as it revolves upon the shaft. If preferred, the circular shelf may rest upon rollers, and revolve without a shaft.

A door opens at the side of the oven, and when articles are to be baked they are placed upon the shelf, which may then be turned round, and thus covered, or discharged, without the necessity of reaching to the back of the oven. The oven may be made exteriorly of cast iron, and lined with brick.

The fire is to be made below, the upper part of the furnace, or fire place, forming the bottom of the oven, and flues from it are to carry up the heat, and conduct off the smoke.

Cooking fires may be constructed around it for boiling and other purposes, whilst the waste heat will go to warm the oven. Above the oven, a chamber may be constructed which will be heated in a lower degree, and will serve to keep articles warm which have been cooked. This heat chamber, we are told, may extend up into the dining room, whilst the oven is in the kitchen. The oven itself, it is proposed to make from two to five feet in diameter.

There are various flues, and other parts, described, and the claim is to "all the above improvements." The revolving shelf, however, is principally relied upon.

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17. For a *Cross-cut Sawing Machine;* James W. Messenger, Windham, Portage county, Ohio, December 21.

A cross-cut saw is to be fixed in a frame within which it is properly strained. This frame is made to slide backwards and forwards between the cheeks of another frame, furnished with the proper apparatus for giving motion to the saw. This last frame is furnished with dogs which are to be driven into the log, to hold it in its proper place. A shaft is to be turned by hand, upon which there is a toothed wheel, mashing into a smaller wheel having a crank upon the shaft which operates upon two pitmen which are to carry the saw frame. The pitmen do not draw against the frame, but each in its turn pushes against the inner sides of it, so that the action upon the saw may be similar to that produced by hand.

That such a machine can be made to produce the intended effect is not to be doubted, but we are by no means certain that its use will be advantageous. It will be too cumbersome to be managed by one man, it will take some time to fix it in its place, there will be considerable friction in its various parts, and the action of the crank without a fly wheel, will not be a good one when thus applied. Upon the whole, therefore, we err greatly in judgment, if two men, going on after the old fashion, will not perform better without than with this improvement.

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18. For a *Machine for letting in Wagon Boxes;* Orlando A. Fuller, Vernon, Oneida county, New York, December 21.

The tool described for letting boxes into the hubs of wagons, will, it is said, enable a man to perform ten fold the work which he can accomplish in the ordinary way. Although some pains have been taken in drawing up the description, it is still so obscure, even with the aid of the drawing, as to preclude our attempting any explanation of it. The model would probably remove this difficulty, but to this

we do not think proper to resort, as it makes no essential part of the patent; a fact, the ignorance of which is a source of frequent error.

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19. For an improvement in the *Boilers of Steam Engines;* Isaiah Jennings, city of New York, December 21.

(See specification.)

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20. For an improvement in the *Coffee or Spice Mill;* Amasa Sizer, Cheshire, New Haven county, Connecticut, December 22.

This mill is intended to turn horizontally; but it differs, materially, in its construction from the ordinary horizontal coffee mill. The whole of it is to be made of cast iron. The lower piece, or bed, consists of a circular part which is convex, or conical, in the middle, and is cast with furrows, or teeth, as it forms one of the grinding surfaces. A rim projects up round the edge of this circular part, leaving a groove between it and the cutting surface, which groove is to receive the rim of the runner, which, with the bed, performs the grinding. The rim upon the bed piece serves to retain the ground material, until it arrives at a part where the rim is removed to allow of a lip, or spout, for its delivery. A projecting piece, or ear, attached to one side of the bed piece, and perforated with holes to receive screws, admits of the mill being firmly secured to a shelf.

The runner is a truncated, hollow cone, adapted to the projection upon the bed, and has a rim fitting into the groove before described. This is surmounted by the hopper, which is also a truncated cone, with its larger end upwards, as usual. The hopper and runner are to be fastened together by screws, and the crank, or handle, by which the mill is to be turned, is cast on to, and projects from, the upper edge of the hopper. In grinding with this mill, the hopper and runner, therefore, revolve together. A suitable screw confines the runner upon the bed piece, allowing it to revolve, and having a thumb screw under the bed piece, by which it may be tightened or regulated.

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21. For an improvement in *Stoves;* Powell Stackhouse, city of Philadelphia, December 22.

Instead of the usual construction, the oven part of this stove is to be made cylindrical, or oval, and to be double, there being one cylinder, or oval, within another, leaving a space between them which forms the flue surrounding the oven. After the heat and smoke have circulated around the oven, they escape by a pipe in the usual way.

The patentee says that whilst different kinds of fuel may be used in this stove, it is peculiarly adapted to the use of anthracite, as the heat is equally diffused around the whole oven.

There is no claim made, but the whole description goes to show that the patent is taken for the making the space between the oven and its case perform the office of a flue; in this, however, there is no novelty, as ovens have been, in numerous instances, so constructed. That described at page 231 is of this description, and we could refer to many others was it necessary so to do.

22. For improved *Bellows;* Luna Bishop, Readsborough, Bennington county, Vermont, December

The blowing is to be effected by vanes revolving in the manner of those used in wheat machines, and for other purposes. A circular drum is to be made, through which a shaft passes, carrying the blowing vanes. There are to be three channels formed by suitable partitions surrounding the vanes, and all leading to one air chest, from which a nozzle is to proceed to the fire. The circular drum is open around the revolving shaft to admit the requisite air. The patentee anticipates that the air will be forced through the nozzle of this bellows in a very condensed state; in this anticipation, however, we apprehend that he will be disappointed, for if much condensed, the very openings at which it is admitted would serve as vents for its escape.

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23. For an improvement in the *Cocoa Nut Cutter;* Daniel Fitzgerald, city of New York, December 22.

A wheel about an inch thick, and fifteen inches in diameter, is to be fixed to turn upon an axis like a grindstone; on one side of the wheel, from four to six irons are to be placed like those of a spoke shave, and there are to be perforations behind each of them through the wheel like the throat of a plane. A standard, or rest, rises from the base of the machine, and stands within an eighth of an inch of the cutter, and upon this the nut is to rest whilst it is being cut. Rows of points are also fixed upon the wheel near each of the cutters, and are made sharp to cut the cocoa nut. The claim is to "the knives and cutters on the wheel." We do not know in what way this operation has been heretofore performed, but are certain that there are machines in use for comminuting other articles very similar to that now described, and applicable to the same purpose.

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24. For a *Quilting Frame;* Brook W. Sower, Leesburg, Louden county, Virginia, December 23.

This quilting frame is essentially the well known tambouring frame enlarged, and placed upon legs. There are to be two rollers, one on each side of the frame, turning on gudgeons, and furnished with rag wheels and palls at their ends. A strip of list, or webbing, is fixed upon each roller, for the purpose of attaching the quilt.—A modification is proposed, which renders the rag wheels unnecessary. Holes are to be made around the ends of the rollers to receive pins, which resting against the frame, or other stop, will serve to secure them in their places.

We presume that the tambouring frames with their rag wheels and palls may still be used with impunity, but should the workman mistake the dimensions given, and make them large enough for a bed quilt, its use is fore (or rather *hind*) stalled, by this patent, the invention consisting in "the before described quilting frame, and the last described modification of the same."

25. For a *Washing Machine;* David Watson, Fayette, Kennebeck county, Maine, December 23.

A box or trough, has rollers fixed upon the bottom of it, extending across it, and forming, longitudinally, a segment of a circle. A vibrating frame, furnished with similar rollers at its lower end, is to be passed backward and forward over the clothes to be washed. So far this machine exhibits all the features by which a very numerous family is designated; but, in general, the gudgeons of the vibrating frame have rested upon spiral or other springs, admitting of its adaptation to the thickness of the clothes; in the present instance, the genius of invention has suggested a substitute for these springs, by putting pulleys on the upper ends of the standards which support the vibrating frame, allowing cords attached to the frame to pass over these, with weights on the ends of the cords which shall be a counterpoise to it. The patentee says, "What I particularly claim, and for which I ask an exclusive right, as my mode of suspending the rollers, is that above specified." We take the liberty of suggesting to the next improver of the washing machine, that a weighted lever, or, if he prefers it, two weighted levers, may be made to answer the same purpose as that which is to be effected by pulleys and ropes.

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26. For a machine for *Netting Pine Apple Cheeses;* William Starr, Norway, Herkimer county, New York, December 27.

The cheese after being taken from the moat, or mould, is to be put into a net of suitable structure. The lower part of the net is to be fastened to an iron, or other strong bar, fixed across a frame; the upper end is to be fastened to another bar, which may then be raised until the twine of the netting properly indents the surface of the cheese; the ends of the bar are then to be slipped over pins which project from the frame, and it is retained in its place. The patentee says that "the cheese can be netted in this way with greater ease and expedition than by any other heretofore in use."

A patent was taken some time since for preparing the moulds of such cheeses so as to give the impression without netting; the pattern being carved or cast within the mould.

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27. For an improvement in *Steam Boilers;* Philo M. Hackley, Herkimer, Herkimer county, New York, December 27.

The steam engine boiler which is the subject of this patent is to be formed of several vertical, concentric, double cylinders, closed at both ends; each of them is to be kept filled with water, and they are to be connected together by proper tubes; they are, generally, to be placed vertically upon the bars of the fire place; the heat and flame are to pass up in the spaces between these cylinders, and, consequently all of them but the exterior cylinder, exposed to its action on both sides. A metallic dome, somewhat convex upwards, covers the whole of the interior boilers, and is fastened to the edge of the inner plate of the exterior boiler. Above the first dome there is a second which is hemispherical; this is attached to the outer plate of the ex-

terior boiler, and forms the top, or cap, of the whole. The water is to rise to a considerable height in the space between these two domes; this water communicates freely with that in the outer boiler, and this in its turn being connected with all the others, by water ways, the whole is to be considered as forming one boiler. It is proposed also to make the bars of the grate hollow, so as to be filled with water, and to connect them with the cylinders.

The foregoing is a mere outline of the general plan, it not being necessary here to notice the supply pipes, water and steam cocks, and other usual appendages to steam boilers, or to particularize the auxiliary contrivances which are described by the patentee; it is necessary, however, to the understanding of the claim, to state that it is proposed to cause the heat and flame to ascend spirally between the boilers, by means of a screw-like partition running up between them, which tends to support them, and likewise to preserve them in their concentric positions.

The claim is to the combination, in one boiler, of two or more cylindrical boilers, all united by tubes, or connected by one common cap; the resting of the inner cylinders upon hollow supporters, and the employment of water tube fire grates, connected with the boilers.

It appears to us that the above claims are too general, as concentric cylindrical boilers are not in themselves new, nor is it new to construct the grating of furnaces hollow, and connect them with the boiler; we apprehend, therefore, that the claim should have been confined to the particular arrangement adapted by the patentee.

Independently of the question of originality, that of utility presents itself as one of great importance, and from reasoning, as well as experience, we are led to the conclusion that boilers, bars, and tubes, constructed and connected like those described, will frequently fail in performing the duty assigned to them. The steam generated in bars and tubes will often exclude the water, and then the action of the fire will destroy them; this has frequently happened, and we do not perceive any thing in the present arrangement to secure this apparatus against the same fate.

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28. For an improvement in the *Caulking of Ships or other Vessels;* Nicholas W. Chevalier, city of Baltimore, December 27.

In the common mode of caulking, the seam between the planks is wedge-shaped, in consequence of which the caulking is apt to start, from the working of the vessel; to prevent this the patentee makes a groove, or hollow, on the edge of each plank; this is filled up by the caulking, which thus forms a tongue, retaining it in its place. The claim is to the forming of this groove.

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29. For an improvement in the *Plough;* John Deats, Roxburgh, Warren county, New Jersey, December 28.

This is to be a cast iron plough, consisting of several parts put together in a manner particularly described in the specification. We shall not attempt any description, but merely give the claim of the patentee, which is to "the before described improvements in the mould

board; the main land side; the bottom land side; the cutter; the projection, or ear, on the share, and space in the same at the heel; the plate of iron under the share; and the dovetailed piece of cast iron in the end of the beam."

30. For a *Machine for Sawing Furrow Boards;* Nathan H. Dearborn, Conway, Strafford county, New Hampshire, December 28.

The term furrow boards is new to us, and we are not able to learn from the specification the use to which they are to be applied; we perceive, however, that they are to be sawed winding, and that very considerably. There is to be a carriage, a saw frame, and a pitman, made in the usual manner, but the saw is to have a twist in the frame to correspond with the winding cut to be given to the log. The machinery by which this winding motion is given to the log is so constructed as to cause it to turn upon pivots as the carriage proceeds. This machinery is but imperfectly represented in the drawing, which is without written references; if well drawn, however, it is too complex to be made plain by verbal description alone. There is no claim, the general arrangement of the machine being considered as new.

31. For machinery for *Propelling Mills, Vessels, Carriages,* and other machinery, by manual labour; Joseph G. Aldebert, Parish of St. Landry, Louisiana, December 28.

Whenever we meet with machinery for propelling machinery, we are instantaneously prepared to repel that invasion of the laws of nature of which such contrivances are almost uniformly the precursors. The idea of putting a man at one end of a machine, and placing between him and the other end a combination of wheels, pinions, and levers, which shall enable him to communicate the power of an elephant at the end of the train, is one which we have never had occasion to repudiate, because we never consorted with it, having in our first lessons in natural philosophy learnt its absurdity. So much for our *proem*, and now for the conclusion of the specification before us, in which we are told that "the lever or levers being worked up and down by the hand, or otherwise, push round the ratchet wheels by means of the rods from the levers to the projections, or arms, on the small wheels; the palls fall into the notches and connect the small with the large wheels, and thus force them round with them. One of these wheels works into the pinion, which gives motion to one of the fly wheels, the other being moved by the levers and bridles. The motion thus generated can be communicated, by proper gearing, to mills or any kind of machinery."

Those who have gone no farther on the road of mechanical inquiry than over the *pons assinorum*, will not need a more extended account of the means and ends of the patented machinery indicated by the foregoing article, to allay all further curiosity respecting it; with those who have not yet set out on the journey, or who have mistaken the road, we have not, at present, time to hold a long talk, and a short one would assuredly be waste of words.

32. For an improvement in *Making Ropes, Cords, Cables, Tow Lines, and Cordage in general;* Aaron Bull, Caroline, Tompkins county, New York, December 29.

The patentee of this improved rope has gone upon the correct principle that some of the metals are stronger than hemp, but we apprehend that in this instance he has failed in the attempt to apply the principle, or fact, to a useful purpose. He, however, is so brief in the description of his invention, that we can give the whole to our readers and still occupy but little space. Threads sufficient to form a strand are to be taken, and in forming it wire is to be laid in the centre of it so as to form the heart. After the several strands are thus prepared, they are to be laid together in the usual way.

We are not told what kind of wire should be employed, and are at a loss to say what will answer the purpose. Iron will rust, gold will be too dear, and most of the metals having but little tenacity, must be counted out. Even copper, the most promising of the family, will break by repeated bendings, and will not yield like the more elastic parts of the strand. We are really apprehensive that if any advantage be derived from this patent it will be confined to the wire drawer, and that the consequent increase of his business will be of but short duration.

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33. For an improvement in the *Skate,* and the mode of manufacturing the same; William Whitaker, city of Troy, Rensellaer county, New York, December 30.

The claim of the patentee will at once indicate the nature and merits of the invention, it is as follows:

"What I claim as new, and as my own invention, or discovery, in the above described skate, manufacture, or improvement, and for the use of which I ask an exclusive privilege, is the application, or use, of cast iron, or other metal, either separate or mixt, (which may be cast,) in producing, or forming, by the operation of cutting the said metal, or metals, entire skates, (excepting straps or strings,) each in one piece, without wood, joint or screw, pin or rivet, and so constructing the same as to combine in a sufficient degree, lightness, permanence, and strength."

The only objection to these skates, which we perceive, is, that being made wholly of a good conductor of heat, they will be much colder to the feet than those mounted in wood. We have no experience in the business ourselves, but have heard this complaint respecting skates mounted with sheet iron. Every horseman knows the difference in cold weather between keeping his feet in, and disengaging them from, the stirrup. With the exception of the circumstance mentioned, we apprehend that this skate is, in all points, a real improvement.

Specifications of American Patents.

Specification of a patent for an improvement in the Boilers of Steam Engines. Granted to Isaiah Jennings, *city of New York, December,* 1831.

To all whom it may concern be it known, that I, Isaiah Jennings, of the city of New York, have invented an improved mode of constructing boilers for steam engines, which improvement is particularly applicable to the boiler heretofore patented by me, but is also applicable to boilers of other constructions. The following is a full and exact description of the boiler as now constructed by me; not intending, however, to confine myself to any specific form or dimensions, but only to render manifest the principle upon which I proceed.

I usually construct my boiler with the exterior form of a cylinder standing vertically. This cylinder may be about twelve feet long, and three feet two inches in diameter. The interior of this boiler is in the form of a truncated cone, which will have the same length with the cylinder, and may be about two feet ten inches in diameter at the bottom, and ten inches at the top. A second conical part is also provided, of the same length with the former, but two inches larger in diameter throughout. These three parts are to be firmly connected together, both at top and at bottom, and between them is the reservoir for water and steam, and within them the fire and heated air passes. The top of the boiler, to which the cylinder and cones are secured, is perforated in the middle for a flue, and has the requisite openings for a steam pipe, valves, &c.

The larger cone is to be perforated with rows of holes at top and at bottom, to open a free communication for water and for steam between the exterior and interior spaces formed by the cones and cylinder. At the top, these holes may amount to a dozen, and half that number will suffice at the bottom. The row at top may be within an inch of that end, but those near the bottom had better be six inches from the lower end. I make them usually about one-eighth of an inch in diameter, and to preserve them from corrosion, and furring up, I usually bush them with gold, or platinum.

Besides the three parts above described, I cause a truncated cone of sheet metal to descend from the top of the boiler to the depth therein of about three feet; allowing about the same space between it and the larger cone as that between the two cones. By means of this, the steam which passes through the upper holes from the interior to the exterior space, is conducted down towards the surface of the water, which stands in the boiler at about two-thirds of its height.

Should a boiler of this description burst, the rent will always take place in the interior, or smaller cone, which is exposed to the fire, and no where else. When such a rent does take place, no more water or steam can be suddenly discharged than that which is contained within the inner space, which upon fair and repeated trial has not

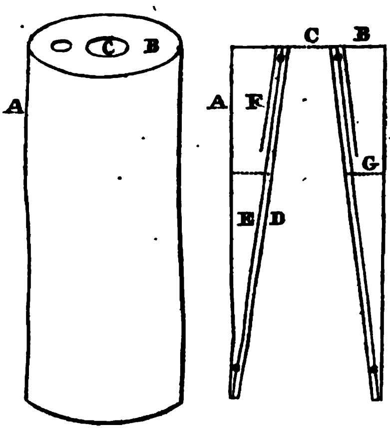
been productive of the slightest personal injury. The smallness of the holes establishing a communication between the two chambers preventing any rapid discharge of the great body of water.

What I claim as new in the present arrangement, is the combining together of the three metallic vessels, so as to form two interior spaces, or chambers, for water and for steam, and the establishing a communication between these spaces, in the manner, and for the purposes herein described: intending to apply the same principle to such boilers now in use as will admit thereof, although they may differ greatly in form from that described.

I also claim as new, and as my invention, the bushing of the holes with metals not liable to corrosion.

ISAIAH JENNINGS.

Jennings' Boiler.



A, cylinder.

B, head.

C, opening for flue.

D, inner truncated cone.

E, larger truncated cone.

F, short truncated cone.

The dots on the larger truncated cone, at top, show the steam holes, at bottom, the water holes.

G, height of water.

ENGLISH PATENTS.

Specification of the patent granted to JACOB PERKINS, *of Fleet street, in the city of London, Engineer, for improvements in generating Steam. Dated July* 2, 1831.

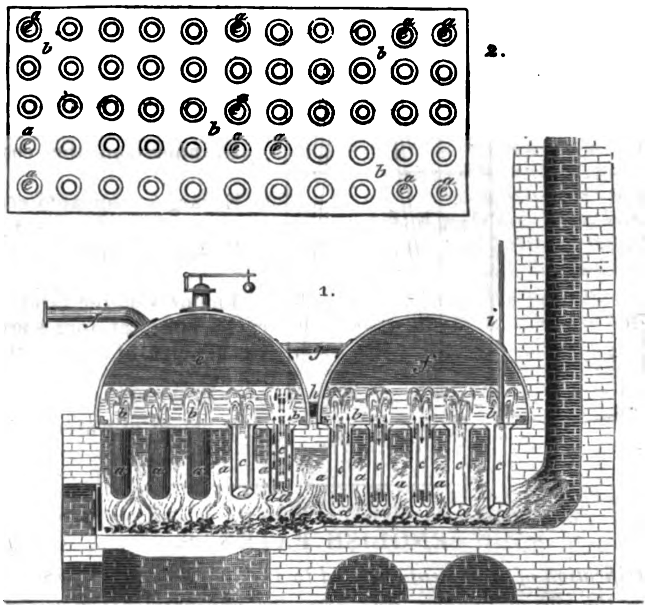
To all to whom these presents shall come, &c. &c. *Now know ye,* that in compliance with the said proviso, I, the said Jacob Perkins, do hereby declare the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the following description thereof, reference being had to the drawings hereunto annexed, and to the figures and letters marked thereon, (that is to say):—

My invention is that of a new method or methods of producing a rapid generation of steam, and consists in an apparatus that may be

constructed with, or superadded, to the steam boiler or generator of steam; this apparatus may be considered as a lining to the internal surface of the boiler or generator, admitting the water to circulate between the two, by passages that are left open at the lower and upper parts of the lining, whereby the heat given off from the inner surface of the boiler, will be rapidly carried up to the surface of the water, and given off with the steam, and such boilers may have a higher degree of heat applied thereto without injuring the metal.

This invention may be more fully understood and carried into effect by the drawings hereunto annexed, which represent the apparatus as applied to three descriptions of steam boilers, by way of example; and I would observe that in each of these drawings, and the figures there shown, the same letters refer to similar parts.

Fig. 1.



Description of the Drawing.

No. 1, Fig. 1, represents the apparatus applied to a boiler constructed with a number of tubes or compartments, descending from the main body, so as to come each into contact with the fire in the furnace, and thereby presenting a more considerable surface to the heat, as will be evident by inspecting this drawing. These tubes are denoted by the letter *a* respectively; the letter *c* represents internal tubes to the tube *a*, open at bottom and also at top; and these are the linings which constitute the invention or improvements. The inner tubes *c* rest on the inner area of the bottom of the tubes

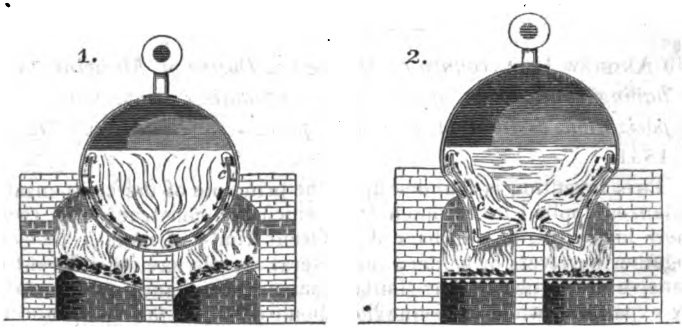
or compartments *a*, on the legs or supports *d*, which keep the inner tubes or linings *c* in their proper places, and leave a space all around as well as at the bottom, to produce the circulation more fully described hereafter.

This boiler is formed of two separate parts, *e* and *f*. No. 1, represents a cross section of the boiler, *g* being a steam pipe which connects the upper parts of the two, and is for the purpose of equalizing the steam therein; *h* is another pipe which connects the water, and keeps it on an equal level in the two; *i*, the water supply pipe; *j*, the steam pipe leading to the engine.

No. 2, Fig. 1, is the plan of the bottom of one of the parts or boilers *e* and *f*, showing the position of the tubes *a* and *c*. With respect to the other necessary parts of the boiler, which are known to every person acquainted with this sort of machinery; it is not deemed necessary to enumerate them, as they are not essential to explain the invention.

On lighting the fire in the furnace, the heat will strike against the outer surfaces of the tubes *a*, and thus give off heat to the water which is in contact with the metal, and such heated water will rise to the surface, and give off so much of it as is converted into steam, whilst the inner column of water contained in the tubes *c* will descend, and continue to fill up the space of that part which has become heated, and is rising to the surface; and thus will a very rapid circulation of the water take place in each of the tubes *a*, caused by the tubes or linings *c*, and by such rapid circulation, however great, the degrees of heat applied to the outer area of the tubes *a*, the rapid circulation will carry up the same, and give it off at the surface with the steam, and thus at all times keep the tubes *a* at a temperature which will not injure the metal, which would be the case were the inner tubes or linings *c* not used.

Fig. 2.



No. 1, Fig. 2, represents the section of a cylindrical steam boiler, such as is usually employed for high pressure engines; and No. 2 is a section of what is termed a wagon boiler, such as is used for low pressure engines. In each of these two figures I have not thought it necessary to show the construction of those boilers, more particu-

larly, they being well understood, and in very general use, the only difference being the addition of the linings *c*, which are curved plates running from end to end of the interior surface of the boilers, but kept apart from each other at the bottom, to admit the passage of the water between them, and kept open and apart from the boiler at the top for the same purpose, such plates being kept to the positions shown in the drawings by means of short rods, which are rivetted or otherwise affixed to the sides of the boiler, and also to the linings *c*. The linings *c* are for the purpose of obtaining a rapid circulation of the water, as described with respect to No. 1.

In Nos. 1 and 2, Fig. 2, it will be seen that I use two separate fire places or furnaces, the object of which is, that the partition of brickwork which runs the whole length under the boiler, should prevent the fire acting under that part of the boiler, by which means the water over such brick-work always contains less caloric than that which is directly acted upon by the fire; and by the action caused by the partitions or linings *c*, a rapid circulation will be produced, which will take up the heat more quickly from the inner surface of the boiler, and give it off with the steam.

Having now described the nature of my invention, and having shown my improvements as applied to three descriptions of steam boilers, it will be evident from the nature of the invention, that the shapes of the boilers may be varied without departing from my invention, which I hereby declare to consist in applying the linings, *c*, by any apparatus, upon the principles and by the methods above described, for the purpose of obtaining a rapid circulation of the water in steam boilers or generators, and thus causing the water to take up the heat from the inner surface of such steam boilers or generators, and thereby producing a rapid generation of steam, with less injury to the metal or material of the boiler, as above described.

In witness whereof, &c. [*Rep. Pat. Inv*

To ANDREW URE, *county of Middlesex, Doctor of Medicine, for his having invented an apparatus for regulating temperature in vaporization, distillation, and other processes. Sealed 20th October,* 1831.

THIS invention is founded upon the principle of the compensation balances applied to chronometers, which are constructed of two or more long slips, or thin bars of different kinds of metal, connected together by rivets or solder; the several metals having different expansive properties under similar temperatures, and, consequently, by expanding when in connexion, bend or warp the compound bar out of its original form or figure. The apparatus is called a Thermostat.

The principle admits of being variously modified in its construction, and may be applied in many different situations, where a varying temperature can act upon it, for the purpose of becoming a self-moving agent. The intention of the patentee is to adapt this con-

trivance to distilling apparatus particularly, in order that by its expansion, or contraction, it may open or close a water cock, and thereby admit such a regulated current of the cooling fluid as shall at all times keep the materials under operation at a uniform temperature. The same contrivances are also applicable to regulating temperature in stoves and heating apparatus of various kinds.

The construction of the proposed apparatus admits of almost as many varieties as its adaptation; the patentee has exhibited several, merely as illustrations.

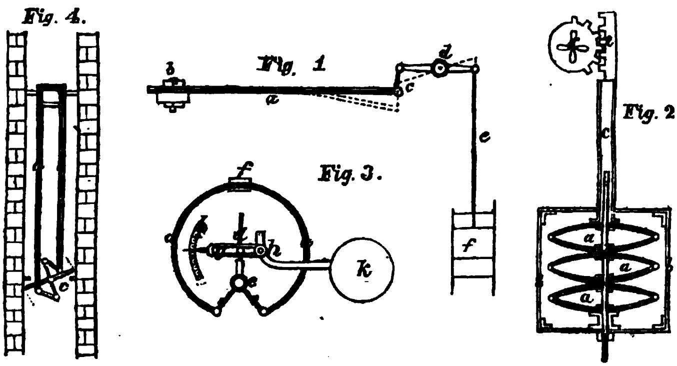


Fig. 1, shows one mode of applying the contrivance; *a*, is a bar, composed of two thicknesses of metal, brass, and steel, united, and made fast at the end *b* to the place where it is to be used, which may be called its fulcrum. At the reverse end, *c*, a link connects the bar to a lever *d*, which by the rod *e*, raises and depresses a sliding door or damper *f*.

When heat is applied to the compound bar *a*, it elongates, and that metal, which expands most under a given temperature, being uppermost, causes the bar to bend down, as shown by dots, and by that means to raise the door. If placed within a boiler, the same might open a cock or valve, and on the temperature being lowered, it would rise and close the cock or valve.

Fig. 2, is another modification of the contrivance, consisting of several pairs of compound metallic bows, *a a a*, connected together, the lower one of which is fixed by an adjustable screw to the bottom of the box *b*, and the upper one to a sliding rod *c*. The outer parts of these bows being composed of metallic bars, which are more readily susceptible of expansion by heat than the inner parts. On the temperature of the surrounding medium becoming increased, the bows rise upon the central pin *d*, and in so doing lift the rod *c*, which having a rack, *e*, at its end, turns the circular piece, *f*, upon its centre, and thereby opens a ventilator, or turns any other apparatus, by which a cool current may be admitted. When the temperature of the surrounding medium becomes lowered, of course the bows flat-

ten, and come closer together, drawing down the rod *e*, and closing the ventilator.

Fig. 3, shows the thermostat in a circular form, that is, a hoop, *a a*, constructed by uniting two thin slips of dissimilar metals. At the open parts of the hoop two levers, *c c*, are attached by joints, and which levers are connected together, and to a sliding rod, *d*, at the joint *e*.

If this hoop, *a a*, be fixed at the part *f* in a vessel, the varying temperatures of which are required to be known, the different degrees of heat will cause the hoop to expand and contract, and in so doing to move the arm *g*, upon its fulcrum *h*, which will cause the cock *h* to open or close the water way of the pipe *i*, leading from a cistern *k*, and by that means to increase or diminish the flow of the cold water from the cistern, according as the heat of the fluid in which the thermostat is immersed may require it. There is a graduated arc, *l*, proposed as a thermometrical scale, to exhibit the temperature which is pointed out by the end of the arm *g*.

Fig. 4, is another modification of the contrivance, designed to be placed within a chimney or flue, for the purpose of opening a damper when the heat becomes too great; *a* and *b* are each a compound bar, composed of two dissimilar metals. These bars are fixed in pendant positions at their upper parts, to a stationary bar in the chimney, and when the heat of the flue causes the compound bars to expand, they will so move the levers at *c*, as to open the damper and admit a current of air to cool the parts within. This arrangement is called a pyrostat.

It must be repeated, that these are only illustrations of several constructions and modes of adapting the principle, but the patentee claims generally the adaptation of combined bars of metal, whose properties render their opposite surfaces susceptible of different degrees of expansibility, under any given temperature, for the purpose of moving levers, or otherwise operating to open or close valves, cocks, or registers, for regulating the temperatures of fluids, or airs, for refrigerating or ventilating. [*Lond. Jour.*

To William Mann, *county of Surry, gentleman, for his having discovered, or found out, that by the application of compressed air, power and motion can be communicated to fixed machinery, and to carriages, and other locomotive machines, and to ships, vessels, and other floating bodies. Sealed* 1*st June,* 1829.

From a perusal of the above curious title, it would appear that the patentee had no knowledge of the application of compressed air in the air gun, or of its adaptation in a thousand other ways, to obtain mechanical power; but even if it had not been known before, his having merely discovered, or found out, that by the application of compressed air power and motion can be communicated to fixed machinery, and to carriages, &c. &c. is not a discovery upon which a patent

can be granted; because the discovery itself is not a vendable matter; whoever therefore, has dictated the title of this patent, has omitted that which should have been the very essential part of it, (viz.) that he has invented or discovered a *mode of compressing*, or *of applying* compressed air, &c. We take this opportunity of pointing out the fatal effects of an erroneous title, convinced that in the present instance, we are not, by the exposure, subjecting a new or useful invention to the jeopardy of legal consequence, and may perhaps be communicating a hint that will be found useful to future patentees.

The specification, which is extremely long, commences by telling us that atmospheric air may be compressed in close iron or other vessels by means of manual or animal labour, by wind mills, water mills, steam engines, and other means, and that when so compressed, the vessel containing the air may be conveyed from place to place, and may be stationed in any required situation: and the air may be let off from the vessel in small currents, and allowed to expand, so as to communicate by its elasticity a mechanical power capable of actuating, or impelling, machinery.

The common mode of compressing air, is by forcing it into a strong vessel, by means of an air pump, by which a large volume of air, at the usual density of the atmosphere, is taken and compressed into a small compass within the close vessel: the pumping operation being continued until the air within has reached that degree of density, or compression, required.

This the patentee proposes to do, by means of a series of air pumps connected together; the first pump compressing the air perhaps ten times, and the second ten times, bringing the condensation to a hundred times that of the natural atmosphere, and so on to any degree of density that may be desired. It is observed that this will not reduce the whole amount of mechanical labour requisite to bring the air to the same degree of condensation, by a single pump, but yet it is to be preferred.

There is to be a reservoir connected to each pump, to receive the air as it is forced in, and a valve to prevent its returning, from which reservoir the condensed volume is taken by the second pump, and still further compressed as we have said above. No drawings accompany the specification illustrative of the patentee's plans, but several elaborate tables are given, showing the required dimensions of the pistons and chambers of the series of pumps, diminishing in arithmetical progression.

When suitable, strong vessels have been thus charged with condensed air, the vessels may be conveyed to the situations in which they are to be employed for actuating or driving machines, and the compressed air being then let out from the vessel, in small quantities, into a receiver, is there allowed to expand to a certain volume or pressure, when it may be admitted into a working cylinder, for the purpose of raising or depressing a piston by its elastic force, in the same manner as steam is applied.

In this way it is proposed that condensed air should be employed as a power, in preference to steam, for driving locomotive engines

and carriages, propelling vessels on water, and working machinery in general. Vessels containing this condensed air may be transported from place to place, like portable gas, for actuating lathes and other small machinery, where steam engines would be inconvenient; and the air, in its condensed state, may be conducted to any part of a manufactory by means of pipes, in the same way that Mr. Hague works his cranes at St. Katharine's Docks.* It is further proposed to employ this power in fortifications for discharging ordinance, by conducting the condensed air through tubes from a reservoir, to any part of the ramparts.

In order to obtain condensed air in large quantities, steam engines are to be employed to work the air pumps; or wind mills, water mills, and, in many cases, the tread mills of prisons may be made available for this purpose.

When the power is to be applied to locomotive carriages running from one town to another, steam engines should be erected, at not more than ten miles apart, to supply the vessels with condensed air as they become exhausted; and in the event of a line of locomotive carriages being established between London and Newcastle on Tyne, the surplus coal may be usefully employed in the neighbourhood of the collieries for producing steam to generate a power for condensing the air, and the vessels may be conveyed to different stations on the road, ready to be taken up for use. (See the specification of C. C. Bombas, for propelling, &c.)†

We presume that enough has been said in the above report to convey a tolerable notion of the scheme proposed by the patentee. It is not necessary for us to say another word as to the originality of the idea suggested, or of the practicability of the project; its obvious absurdity and uselessness must be perfectly evident.

[*Lond. Jour. March,* 1832.

Patent granted to ADOLPHE JAQUESSON, *of the county of Middlesex, Esq. for certain improvements in machinery applicable to Lithographic and other Printing. Communicated by a Foreigner. Dated July* 6, 1831.

THE patentee is not the inventor of this complex machinery. It comes from abroad. None of its parts are new, but for their original combination, and novel application, the patent is claimed. The machine itself will be found extremely useful: it is a printing press, whereon impressions may be taken from a steel or copper plate, a wooden block, a stone, or a form of type. Engraving, lithography, and printing, all by one process! There are a frame of strong angle iron, a sliding table, a cylinder, and the means of motion and communication.

The principle of the rolling press is evidently that which is here used. The table moves in grooves, or by a rail-road, and the cylin-

* Lond. Jour. 2nd series, vol. i. p. 95.

† Ib. vol. ii. p. 278.

der is lifted up so as to justify its space to the different substances, from the copper plate to the block of stone. Proportionate weight is given, so as to regulate motion—into quick for utility, slow for excellence. Cog wheels and flies are the instruments of motion. Any power may be made to act. The motion of the table is horizontal, under the cylinder to receive the pressure, and back again to be inked. The action of the cylinder is, of course, rotary on its axis. The whole machine differs little from the usual rolling press: its great distinguishing feature being the power of elevating or depressing the cylinder, so as to allow it to act with regulated pressure on a thin substance, or on a thick one. The inking process is the same as that used in the usual presses. There is no doubt that (if the materials be reasonable, and the machine portable) it will be useful and popular.

Patent granted to Baron CHARLES WETTERSTADT, *county of Middlesex, for a composition or combination of materials for sheathing, painting, or preserving ship bottoms, and for other purposes. Dated July* 6, 1831.

MR. WETTERSTADT's "composition or combination" for sheathing ship bottoms, &c. consists of regulus of antimony and lead; 100 parts lead, and from three to ten per cent. of antimony, boiled, stirred and skimmed. When thoroughly combined, it is poured into cast iron moulds of sixteen inches, by eight and a half inches of superficies, and half an inch thick. The plates when cold are passed between rollers and flatted out to sheets measuring thirty-four inches by sixteen inches. The next process is to paint these sheets with an amalgam composed of two parts lead, melted with one part antimony, and seventeen parts quicksilver, heated to 300° or 400° of Fah. [An ample latitude this, in an accurate detail of a specified process.] The amalgam to be stirred, and cooled down to the consistency of honey, when the sheets are to be painted with it; [no direction is given as to the portion of amalgam to be laid upon each sheet] and afterwards passed between the rollers as before, but in an opposite direction, and flatted out till they are from fifty-two to fifty-eight inches long, and sixteen inches wide. When the sheets are destined for the roofing of houses, and similar employment, the additional process just described is not requisite.

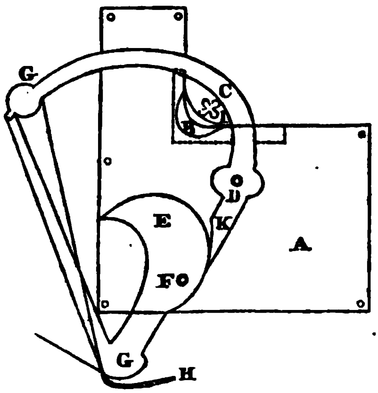
The *paint* for ship bottoms, paling, and other outside work, is composed of finely sifted dross and sulphur; equal parts of each melted together, and so carefully as that the sulphur may not take fire. The material is laid upon the ship, paling, &c. either by previously heating these, or by means of hot flat irons of such a temperature as not to fire the sulphur.

Mr. Wetterstadt states that his reason for confining himself to from three to ten parts of antimony, to the 100 parts of lead, in the composition of the sheathing, is, that the latter proportion would ren-

der the metal too brittle, and that the former quantity would be too small to produce the effect he requires: then why not state the exact proportion of antimony he deems the most beneficial to his purpose?

The patentee does not insist upon the employing of copper nails in his sheathing. [*Rep. Pat. Inv.*

Patent granted to William Batten, *county of Kent, for an apparatus for checking, or stopping, Chain Cables, which apparatus may be applied to other purposes. Dated July* 13, 1831.



The accompanying representation of Mr. Batten's invention is rather intended to convey a rough idea of its mode of operation, (which we could not do satisfactorily in words,) than a correct drawing as to the several proportions and accurate bearings of the machinery, for it was sketched from memory, after an inspection of the original drawing and specification.

The apparatus is intended to be fixed under the hatchway of the deck. The whole to be composed of wrought iron. A, is an iron plate; B, a thick boss of the same, over which the chain, or cable, I, runs; C, a lever playing upon a fulcrum D; E, an eccentric lever, moving upon its fulcrum F, and acting upon the second short lever K. The chain or cable I, is nipped, or stopped, altogether by the extreme ends of each lever being compressed by means of a rope that passes through the pulleys G G. And in order to set the chain or cable free the lever may be retracted by a short rope, H, fastened to the extremity of the lever E.

[*Rep. Pat. Inv.*

On Bridges and Ferries.

A correspondent residing in Camden, South Carolina, has called our attention to the subject of bridges and ferries, referring to "the admirable account" of them "as constructed and used across the Rhine, in Dwight's Germany," and adding, that he "cannot but believe, with Mr. Dwight, that they would be worthy of adoption with us, and that the War Department would render service to the community by procuring the estimates of their cost, the detail of their practical value, and the principles on which they are conducted."

We subjoin the following extracts from Dwight's Germany, which, we believe, comprehend all that he has given to us upon the subject.

At page 11, speaking of the river Rhine at Mayence, he observes that it "is here a noble stream, and the only one I have seen in Europe which reminded me of the rivers in the United States. A bridge of boats is thrown across it, on which you pass with as much comfort as over those of stone which arch the Seine. This species of bridge, which I have never seen when travelling in my own country, is so simple, so cheap, and at the same time so convenient, that it is surprising we have never introduced it. It is composed of fifty-six boats well ballasted, that they may not yield too easily to the current, and which are anchored in a straight line, with chain cables. The force of the steam carries them down until they have let out all their length of cable, they are then parallel to each other, their bows being turned to the current. Large beams extend from boat to boat, and across them, at right angles, planks are placed. A bridge is thus formed in a few days. As winter approaches, it is taken to pieces to avoid the floating ice, and on the approaching spring it resumes its place again."

"My desire (he observes at p. 24,) of seeing Frankfort, and the beauty of the Rhine, induced me to return to Mayence. Between Cologne and that city there is but one bridge of boats, at Coblentz. There are, however, several moving bridges resembling our steam ferry boats in their construction, but much superior to them in one respect, that they are always in operation, and with no expense to the proprietor but the wages of the boatmen. A boat is anchored about half a mile above the ferry, in the centre of the stream; to this another is attached by a chain of twenty or thirty feet in length, and to this a third is united, and so on until the last chain reaches the ferry boat. The length of the chain connecting these is continually increasing. The first is anchored very firmly; the others are floating. The force of the current acting on them, and on the large one, is sufficient to carry it from one side to the other. Thus, without fuel or horses, they move from one bank to the other, with almost the same velocity as our team boats, and without any effort but moving the helm."

We have received, since the letter of our correspondent, the March number of the London Journal of Arts and Sciences, containing a communication on "Flying Bridges," which we have transferred to our pages as pertinent to the present subject. The mode of crossing ferries mentioned by Mr. Dwight has been sometimes used in the United States, and that referred to in the London Journal as having been used at Gravesend, in England, was for a considerable period employed on the Hudson river, opposite Troy, in the state of New York, where we have repeatedly crossed by its aid. Like many other old and well known contrivances, a patent was obtained for it, we believe, in the year 1808. Neither the width of the river at Troy, or the constant passing of vessels, admitted of the stretching of a rope above the water, as is practised at some ferries on the continent of Europe; it was allowed therefore to lie on the bottom, as at Gravesend. In order to preserve the proper obliquity of the boat to the current, it was connected to the block which runs upon the crossing

rope, by means of two ropes, one from the stem, and the other from the stern; and by lengthening or shortening one of these, the head was made to point up the stream in crossing in either direction. There was a false keel to the boat, which was a plank of considerable width and made to turn upon a centre pin, so as to be readily shifted, so as to point more up the stream than the boat itself, and it was in fact upon this part that the force of the current was principally exerted.

Various circumstances concurred to induce an eventual abandonment of this mode of crossing. Occasionally, the rope parted and subjected the passengers to delay and inconvenience: this breaking of the rope was sometimes caused by its contact with the keel of one of the numerous vessels ascending and descending that river. Floating ice for a season interfered with its use, whilst the ordinary ferry boats could cross with facility. The tide also rises high enough to produce slack water at Troy, and this consequently interfered with the action of the boat, which is fitted only for places where there is a constant current.

We have said that this plan was patented, but of course, the patent, as such, was worthless. Another patent for a very similar contrivance was obtained by M. D. Brown, of Mason county, Virginia, on the 1st of October, 1830; we do not know, however, that this mode of crossing ferries is now in actual operation in any part of our country. When circumstances admit of their use, we apprehend that the swinging boats, or moving bridges, as they are denominated by Mr. Dwight, would be preferable to the crossing ropes.

We have said more upon this subject than we intended, designing merely to call to it the attention of those who are conversant with the subject; much has been published respecting it, the construction of floating bridges having been treated at length by writers on the military art; and it is well worthy of enquiry to ascertain to what extent, and in what situations, such can be advantageously constructed for general purposes; and also what mode of construction, under all circumstances, is the most eligible. [Editor.

On Flying Bridges.

To the Editor of the London Journal of Arts, &c.

Sir,—Flying bridges are rarely if ever used in this country, because whenever there is any intercourse between the opposite banks of a river, it is generally sufficient to justify the erection of a permanent bridge, and the breadth of our rivers is not in general such as to render the construction of permanent bridges impracticable; moreover, where they are broad, they are seldom rapid enough to prevent a ferry boat from crossing with tolerable ease and expedition.

From their simplicity and cheapness, and the expedition with which they can be constructed, flying bridges are of great use in military operations; they are also very common on the broad and

rapid rivers of the continent, and although little used in England, are not undeserving of attention.

A flying bridge is formed by fastening a floating body to the end of a cable or chain, moored in a river, and keeping the body by a rudder, oblique to the direction of the stream; the action of which against the oblique side of the floating body, drives it away towards one of the banks, moving it in an arc of a circle, about the moorings of the cable.

Fig. 1.

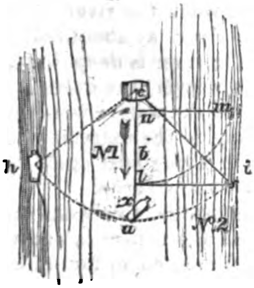


Fig. 2.

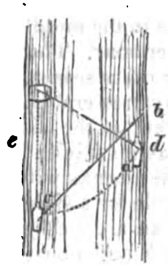


Fig. 3.

Fig. 1 represents a floating bridge; *a*, a boat fastened by a cable *b* to a buoy, or an anchor, at *c*. The current running in the direction of the arrow No. 1, moves the boat *a*, in an arc of a circle about *c*, away from the bank *h*, towards the bank *i*.

The force which urges the boat *a*, in the direction *h*, *i*, depends upon the obliquity of the boat to the current, and is greatest when the side *x*, makes with it an angle of 54° 44′.*

A bridge of this kind is in use on the Rhine, for crossing opposite Nymuegen. From the bank opposite to Nymuegen, a bridge of boats is built, extending rather more than half across the river. The flying bridge is a platform, or piece of road, laid on a strong barge, to which one end of a chain is made fast; the other end of the chain carried over and fastened to the masts of seven boats, to support its weight, and is moored in the river at some distance up the stream. The barge is steered oblique to the stream, and according to the direction of its obliquity, swings round in an arc of a circle, from the end of the bridge of boats to a jetty on the Nymuegen bank, or *vice versa*. The stream runs about three, to three and a half, miles an hour.

In very rapid rivers, flying bridges should not be made both to cross and recross by the action of the current; for the resistance to the motion of the boat in the ascending part of the arc (viz. in the direction of the arrow, No. 2,) is very great, and the descending force of the stream, to drive the boat down the river, negatives the effect of its oblique action on the boat, to drive it upwards about the moorings of the cable.

In such cases, it is adviseable to make the flying bridge move only one way by the current, viz. in a descending arc, and to haul it back

* Vide Douglas on Military Bridges, p. 94.

by a second cable; thus the boat *a*, fig. 2, crosses to the bank *e*, through a descending arc from the bank *d* to *e*, taking with her a rope *b c*, by which she is hauled back from *e* to the bank *d*.

On the other hand, a flying bridge will not act well in a river with a very slow current at the sides, unless jetties or bridges of boats are built out from the banks, some distance into the river, for the flying bridge to come up to; for when the current at the sides is slight, it will not carry the boat close up to the shore.

A flying bridge was established a few years ago across the *Kistna*, in India: the breadth at the part where the bridge was made is between 700 and 800 yards in the rainy season, when the river is full, and the stream then runs in the middle of the river, at about four, to four and a half, miles per hour. The bed of the river is deep, but the sides shelve up. In the rainy season, when the river was quite full, the flying bridge acted very tolerably, but when the waters were out, the strength of the current at the sides, owing to the extreme shallowness of the water, was insufficient, and the flying boat could not be made to come up to the banks within about forty yards.

When a river is too wide for a simple flying bridge, two boats may be used, one moving in an arc *c d* fig. 3, about the centre *a*, and the other in an arc *e f* about *b*, and a boat or a raft moored in the middle of the river, for shifting the passengers from one boat to the other. Or the raft may be dispensed with, and the cables shifted when the boats come close up to each other; the boat *d* being then made fast to the cable *b e*, and the boat *e* to the cable *a d*, so that each boat will go across in two stages from one bank to the other, through *c d* and *e f*.

Sir H. Douglas recommends this plan, in preference to having a raft in the middle;* we apprehend it might be attended with more danger of the boats fouling and doing injury, if the current were very rapid, for both boats would be moving at their greatest speed, just where they would meet, viz. in the middle of the river; and hence the shock, if by accident they were to strike each other, would be twice as great as the shock of one boat against a stationary raft. Also the difficulty of managing them in a rapid current, to change the cables, would be considerable, and the operation tedious.

We are not aware whether this plan has been extensively adopted in practice. The other is adopted in effect, and answers very well in the Nymuegen flying bridge; for though it has not two boats, the flying boat comes up to the stationary end of the bridge of boats, nearly in the strongest part of the stream.

In flying bridges, the cable should be of a good length, for when it is long, the flying boat moving through the arc of a large circle, has to ascend the stream less than when the cable is short; that is, its direction is nearer to a straight line across the stream, and, consequently, less of the effective force of the current to impel the boat across, is abstracted by the resistance of the current to the ascent of the boat. For instance, in fig. 1, with the cable *c a*, the boat

* See Douglas on Military Bridges.

moves upwards, equal to a distance $a\ l$; but if the cable were only as long as $c\ l$, the boat in crossing would move through a distance $l\ n$, against the stream, which is much greater than $a\ l$.

The whole motion of the flying boat from side to side, should not exceed a right angle, and then the angle $a\ c\ s$, fig. 1, will not exceed 45°; for when the angle $a\ c\ s$ exceeds 45°, the force $c\ l$ that impels the boat sideways, in opposition to the current, becomes less than the force $l\ s$ which holds it to the centre. This is shown by the triangle $c\ n\ m$, fig. 1, where the angle $n\ c\ m$ is more than 45°. The force $n\ m$ is greater than the force $c\ n$, and the boat would not, in fact, rise by the oblique action of the stream so far as m.

In narrow rivers, not exceeding two hundred yards in width, and with a tolerably rapid current, a flying bridge may be applied with effect, in the following manner:

Let a cable be stretched across the river from bank to bank, and attached on each side to a frame secured in the bank, and drawn tight by a windlass; then attach the flying bridge to this cable, by means of a short rope, with a running block on the cable, and by keeping the boat in an oblique direction to the course of the stream, it will be carried across by the force of the current with considerable effect and expedition. This mode of establishing a flying bridge is more easy of adoption than the former one, and is attended with far less expense and trouble, as the buoys for the support of the cable may be dispensed with, and also the anchor for mooring it in the river.

This plan was used to establish a communication across the Thames at Gravesend, during the threat of invasion from France. The cable was suffered to sink to the bottom, not to interrupt the navigation, and as the boat crossed, the rope rose to the point of suspension on the bank.

The cable should not be sunk when it can be avoided, because the boat has then to move the weight of the rope that connects it to the cable; and, moreover, the running block will run with a great deal more friction upon the wet cable than when it is out of the water.

A triangular raft may be floated over a river, as well as a boat, if it be connected to a warp, or to a moored cable, in any of the ways we have described, by keeping one of its sides oblique to the direction of the stream.

Another mode has been found to answer well, viz. anchor the cable in the middle of the stream, and pass it over a pier of wood or masonry, built in the river, to the flying bridge on the opposite side of the pier. The bridge is then carried across the stream, if kept oblique to it, by the force of the current acting against its side, without the necessity of using buoys or boats for supporting the cable, which, at all times, tend greatly to impede the motion of the bridge, because the current acts upon them in an opposite direction to that in which it affects the flying bridge itself, and the latter has therefore, in effect, to drag the buoys through the water, against a considerable resistance.

When a river exceeds two hundred yards in width, it is necessary

to adopt the mode of mooring the end of the cable in the stream, and passing it over buoys, or a pier to support its weight; but where a river is less than two hundred yards wide, the system of causing the flying bridge to traverse the river on a cable stretched across it from bank to bank, may be considered as far preferable in every respect.

P.

Prevention of Falsification of Written Instruments.

The attention of the French government has long been directed to the possibility of finding some means of preventing writing being chemically discharged from papers and other documents, either for the purpose of falsifying the contents, or for making a second and fraudulent use of old stamps. With this view the Academy of Sciences was directed to take the subject into consideration, and a committee, consisting of MM. Gay Lussac, Dulong, Chaptal, Deyeux, Thenard, D'Arcet, Chevreuil, and Serullas, was appointed for the purpose. The attention of the public was called to the subject, and a great number of specimens of ink, alleged to be indelible, were forwarded to the committee. Numerous experiments were made, and on the 30th of May, and 6th of June, the report was read to the Academy by M. D'Arcet. It is unnecessary for our purpose to follow the reporter through his elaborate history of the different manufactures of ink in different ages, or the detail of the experiments made with the various samples submitted to the committee; it is sufficient to state the conclusions which were unanimously adopted as the results of the investigation. These were, that the falsification of written documents will be fully prevented by the use of ink prepared in either of the two following manners: 1. Indian ink, (or in its absence the imitation of it made in Europe with soot and animal glue or gum) dissolved in a mixture of water and muriatic acid, of the specific gravity of 1010, (1½ degrees of Beaumé's instrument.) This ink may be prepared for four pence English per quart. 2. To a solution of acetate of manganese, of the specific gravity of 1074, (10 degrees of Beaumé,) add half its volume of solution of carbonate of soda crystallized, saturating it at about 166 per cent.: dissolve India ink in this liquid, and writing traced with it will become perfectly indelible on being exposed to the action of the vapour of liquid ammonia. The committee lay down, as a general principle, that no ink, kept in a liquid state, can be indelible, as the colouring matter, from its excess of density, will necessarily be deposited. Additional security will be obtained by writing on paper so prepared, that even if the ink could be discharged, it would necessarily be seen that it had been so discharged. Thus, M. Coulier proposes a paper, having printed on each sheet, lines and patterns, so complicated, as to defy forgery, and struck off from a steel plate damasked with aquafortis. The ink with which this is printed would be discharged by chlorine, so that the superjacent writing cannot be destroyed without also destroying the drawing. The plan is excellent for bills of exchange

and other small documents; but from the expense and delay occasioned by the engraving and printing, the designs would be ill adapted for legal proceedings and public documents. M. Chevallier proposes a paper coloured in the pulp with colours liable to be discharged by all the known re-agents, but this might easily be recoloured when the alteration is made. M. Maimu suggests adding to the pulp of the paper filaments of wool, cotton, or hemp, dyed of different colours, some of which will be acted on by the acids, and others by the alkalies, but all liable to be discharged by chlorine. When these colours are discharged, it is almost impossible to restore them; but the writing may, in some cases, be effaced without any sensible alteration in the colour of the filaments; and on the other hand that colour will frequently change by simple exposure to the air, without any re-action being used. Mr. Coulier's method is by far the best, but has the disadvantage, that all designs easily dischargeable from the papers may become injured by time or accidental circumstances; a consideration which, in cases of forgery, would tend to render probable the impunity of the guilty by the fear which would be entertained of condemning the innocent. The use of these prepared papers must therefore be considered as very secondary, the main security must be found in the indelible inks. The discharge of the writing from old stamped documents, and the consequent fradulent use of the stamp, may be prevented. 1st. By printing on all stamped paper, by means of a cylindrical press, an engine-turned vignette, placed on the right of the stamp, in the centre, and along the whole length of each sheet. 2nd. By employing, in printing these vignettes, a colour having for its base the black precipitate formed in the dying coppers of hatters, or ink thickened in the manner adopted in the manufactories of painted cloths. And 3d. By marking on all stamped papers, the date of their fabrication, either by printing it in the pulp, or engraving it on the vignette or the stamp; or, more simply still, by making the dry stamp, impressed on each sheet of paper, revolve, so as to affix a new date each year. This report was ordered to be transmitted to the Minister of Justice.

[*Jour. Royal Ins.*

Blue extracted from the Stalk of Buck-Wheat.
(*Polygonum fagopyrum.*)

A BLUE colour, serviceable for dying, may be extracted from buck-wheat, in the following manner:

The stalks are cut before the grain has become mature; they are spread out upon the earth, exposed to the sun, and suffered to remain till the grain separate with facility. When this has been effected, the straw is collected, wetted, and allowed to ferment until decomposition take place, and the heap have assumed a blue appearance. It is then formed into balls, or cakes, and dried by the sun, or in a stove. These masses being boiled in water will impregnate it with a deep blue, which neither vinegar nor sulphuric acid

will discharge. Alkalis will change it to a red; the powder of nut-galls reduce it to a perfect black; and, by evaporation, it will become a beautiful green. Stuffs dyed with this preparation, and by the usual method, take the dies from other vegetable substances; the blue is very beautiful, and the colour stands well.

[*Jour. Etrangers.*

Transport of Edifices.

On the 2nd of May, M. Gregori alluded to a circumstance mentioned in a late number of the Journal des Artistes, of a rock of granite, forty-two feet long and twenty-seven high, having been transported from the bay of Finland to St. Petersburg, to serve as a pedestal to a statue of Peter the Great. He stated that a much more remarkable fact had occurred at Crescentio, in 1776, when a common mason, named Serra, succeeded in transporting a brick belfry, which he had contrived to cut from its base without injuring the walls, from one church to another, at a considerable distance. While it was being moved, a man inside rang the bells. A model of the machine employed in the transport, was deposited in the library of the institute.

[*Proceed. of Roy. Acad. of Sci. of Paris.*

Protoxide of Copper.

The simplest and easiest method of obtaining protoxide of copper is the following:—Dissolve the copper in muriatic acid, to which small portions of nitric acid are to be added; afterwards evaporate to dryness, and heat the chloride obtained to its fusing point. It is thus converted into brown crystallized chloride. It is afterwards to be fused, ten parts with six of dry carbonate of soda, in a covered crucible, at a low red heat. The mass is to be treated with water, to dissolve the common salt formed; the protoxide of copper separates in the state of an uncrystalline powder of a fine red colour, which is to be washed and dried.

If muriate of ammonia be added to the above mixture, all the chloride is reduced, as will readily be foreseen, to metallic copper, which separates in a very divided and spongy state, when the mass is dissolved in water. [*Phil. Mag.*

Means of preventing Incrustations in Steam Boilers.

M. Ferrari has announced to the Royal Academy of Sciences of Turin, that he has observed that charcoal in coarse powder prevented incrustations from forming in the boilers of steam engines, and detached them when they have already formed.

[*Jour. de Chimie Médicale.*

INDEX.

AMERICAN PATENTS, LIST OF, WITH EDITOR'S REMARKS, &c.

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OF THE

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DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED
BY THOMAS P. JONES, M. D.

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JULY, 1832.

FRANKLIN INSTITUTE.

Explosions of Steam Boilers.

Communication to the Committee of the Franklin Institute, on the Explosions of Steam Boilers, from Thomas Ewbank, *of New York city.*

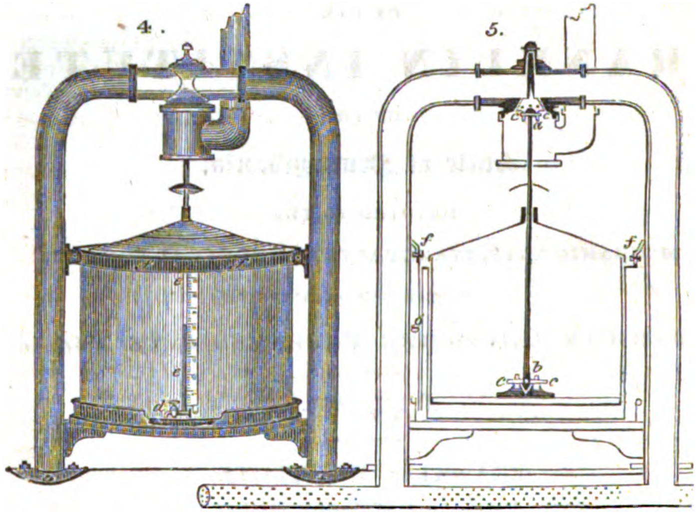
(Continued from p. 369, vol. ix.)

An improvement in the safety valve, particularly in obtaining and limiting the pressure upon it, is still considered a desideratum. The result of my efforts on this part of the steam engine is the hydrostatic valve published in the last number of the Journal, (vol. ix. pp. 64 and 65,) and to which I beg leave to refer. It combines *both* the valve and gauge with its tell-tale. As a gauge *alone*, for high pressure engines, I think it deserving of attention.

The committee can determine whether the defects of the ordinary safety valve are obviated or not in this device. A simple addition, made to it since the first description was written, may here be mentioned, as it is a still further security against adhesion. A slit *a*, (see fig. 5,) is made in that part of the valve which receives one end of the rod, and a similar one, *b*, on the plate that receives the other end in the bottom of the inner vessel: a short pin, *c c*, is passed through the rod at half an inch from each of its ends, which slip loosely into the slits, (the rod pressing only on its central points,) so that when the inner vessel is moved round, the valve is moved round also with it, even when the steam is pressing against it.

It is often desirable to know the strength of the steam when not blowing off; to ascertain this, the cock *d* (in fig. 4) is opened, and the water allowed to subside until the steam begins to open the valve, when the mark on the glass tube *e e*, opposite the surface of the fluid,

indicates the pressure. The figures just referred to, are given because they represent this valve more in detail than the plate formerly



given. In the plan of the valve, as first described, the liquid was suffered to run over the edge of the outer vessel. Now a rim, *f*, is added, from which a pipe, *g*, (fig. 5) conveys the surplus fluid into the receiver below. This pipe passes down behind the graduated plate shown in fig. 4. The cocks figured in the former plate are dispensed with. The tension of steam indicated by the plate, (see fig. 4) is 50; the surface of the fluid being at that height in the glass tube, and consequently the same in the outer vessel. The rim of the outer vessel is bolted to the steam pipes, to prevent the apparatus from being raised, thus preventing the valve from opening. It has been suggested that the evaporation of the fluid in the outer vessel, would require a constant supply. This supply is abundantly furnished by portions of condensed steam frequently oozing through the valve. (See remarks on the valve, p. 69 of the last volume.)

Should mercury, instead of water, be used, the hydrostatic apparatus should be made of cast iron, and turned smooth; the rim on the outer vessel being made capacious enough to receive the surplus fluid expelled by the opening of the valve. The size of the whole would scarcely exceed one-twelfth of that for water. No cocks in the outer vessel would be required. I have a plan and drawings of one, (including the gauge,) for mercury, but as it has not yet been put in practice, I need not describe it.

3d. Deficiency of water.—This is directly and indirectly, perhaps, the most frequent source of the injury and of the explosion of boilers. Many boilers have been caused to leak, and others have been rendered useless by being overheated and burned, while little or no water was in them, although no explosion was produced.

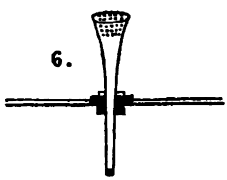
A boiler, (the one alluded to in the former part of this communication,) which I erected about three years since, was, when nearly

new, in danger of being destroyed from this cause. The water had been permitted to subside below the flues, and the first intimation of the fact was given by the steam rushing violently out of the steam pipe, at a joint five feet from the boiler, the solder of which it had melted. The covering round the pipe and the packing of the piston were also burned by it. In this instance, the boiler was probably saved by the fusion of the joint. It was made of common plumber's solder, the melting point of which is about 400°.

This circumstance naturally leads the mind to fusible plugs and plates, as the principle on which they act, was fully exemplified in the melted joint. It would appear that some similar mode of applying them would be more advantageous than the ordinary way of placing them in the bottom of boilers.

A very small iron or copper tube, of a tapering form, inserted into a boiler, and having one end closed by a fusible plug, (or a few inches of the closed end formed of the fusible metal,) would answer every purpose of a "tell-tale." The small escape of steam would be no very serious occurrence to passengers, or to the progress of the boat; yet it would be sufficiently so to the engineer to secure his attention. The fusible tube should be *thinnest* where it unites with the other, as in that case it would melt there first, and would then drop into the boiler, leaving the pipe clear. (See fig. 6.) The upper end ought to be closed and perforated with holes to prevent it from being plugged up.

6.

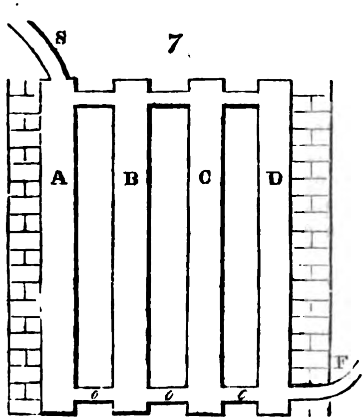


A deficiency of water is supposed by many to have been the primary cause of the dreadful explosion (Sept. 24, 1830,) of a high pressure cylindrical boiler, belonging to Mr. M'Queen of this city: this explosion entirely demolished the large brick building in which the boiler was placed, and killed the engineer, and one other person. The boiler was twenty feet long, thirty inches in diameter, and made of one-fourth inch American iron; it had no interior flues, and was in very little worse condition than when new. It was placed a little below the level of the street, in the lowest floor of the building, its front end facing the street. The fracture took place near the bridge wall, or further end of the furnace, (its hottest part,) and divided the boiler into two pieces. The front end of the boiler, about five feet long, was projected through the front wall of the building, across the street, through the front of a frame house opposite, and lodged in the middle of the second floor. The other piece was found resting on a part of the bed of brickwork in nearly a perpendicular position, with the fractured end upwards.

The line of the fracture was very irregular, not confining itself to the seams, but passing through the middle of one or two of the sheets. The engine was going at an increased speed, so as to attract the attention of Mr. J. M'Laren, the foreman of the foundry, who directed the attendant to slacken it, as the blast of air to the cupola furnace, (the apparatus for producing which the engine was driving,) was too great

at the time. In about five minutes after this, the explosion took place. It is supposed that the attendant had discovered, immediately before the explosion, that there was a deficiency of water in the boiler, and had just opened the communication with the forcing pump, as he was found lying by the feed cock which was open. He might, however, have had the direction of Mr. M'Laren in view in performing that operation, *if the cock were not actually opened before the directions were given.* The appearance of the fractured part gave no indication of the boiler having been burnt, or otherwise injured by the fire. The load on the safety valve, or the tension of steam necessary to raise it, was wholly unknown, and yet additional weights were occasionally added. The attendant had been recently employed on the premises as a labourer, but from his representing himself as having previously had charge of an engine, was permitted to attend it. He is generally believed to have been very incompetent for so important a charge. An unusual difficulty occasionally attended the feeding of this boiler. When the steam was very high, and the water low, the pump could not force the water through the feeding pipe, until it (the pipe,) was cooled by the application of cold water "*to condense the steam in it:*" after the pipe was once filled with water, the supply was continued without difficulty. It would seem from this, that the water must have been very low, or that the feeding pipe did not descend low enough into the boiler; it might, however, have been influenced by the resistance of the heat, which subject, the following observations may still further illustrate.

When several boilers, on the same level, are used together, and fed by a pipe attached to only one of them, (the rest being connected by tubes to the first,) water will not stand on the same level in each; on the contrary, those boilers which are most highly heated, will *always* have the *least* water in them. This fact has been repeatedly, and I think conclusively, established. It has been a common occurrence in the use of those thin rectangular boilers so often used for small stationary engines. Fig. 7, represents a vertical section of a set of these boilers belonging to Mr. Fanshaw of this city, and will serve for illustration. A, B, C, D, show the front end of the boilers; F, the feeding pipe, which terminates in D; C, B, A, are supplied with water from D through the tubes *o o o*; S, is the steam pipe.

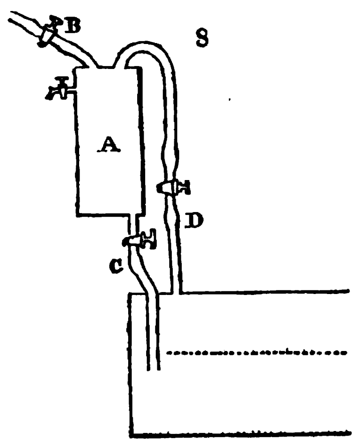


The external sides of A and D are inclosed in brickwork. The fire circulates under and between the boilers, embracing both sides of B and C, but only one side of A and D. Consequently, the temperature of B and C is kept at a higher range

than that of A and D. Now there was always great difficulty in keeping the water in the middle boilers, *though none whatever in the others.* It would frequently stand twelve inches higher in them than in B and C, and yet *it had to pass through them to feed* A, (which was always fully supplied;) B and C were also *frequently burnt out*, while the others remained perfect. This is, in my judgment, a very clear exemplification of the great repellent power of heat; the deficiency not being caused, (as was supposed,) from the greater elasticity of the steam in the middle boilers, for the pipes uniting them at their upper parts, would equalize the tension of the steam in all. It presents also a strong admonition to have each boiler (where several are used,) supplied with water independently of the rest.

Mr. Fanshaw adopted this plan, for which a patent was obtained,* and by it has completely avoided the difficulty and danger above mentioned.

In attempting to devise other modes of supplying water to boilers, the most promising in appearance was the following:



A, fig. 8, represents a closed vessel placed above the boiler, so as to be surrounded by the flues of the furnace, after they leave the boiler. This vessel is supplied with water by the pipe and cock B, from a reservoir: the small cock at top is to allow the air and steam to escape for that purpose. The water descends from A into the boiler by the pipe and cock C. The pipe and cock D are to admit the steam on the surface of the water in A to neutralize the pressure of the steam on the mouth of C, after the two upper cocks have been closed.

This apparatus did not answer the very sanguine expectations formed of it. Mr. R. M'Queen, jr. also attached it, in 1828, to one of the boilers in their establishment. It was, however, laid aside as inferior to the pump.

In endeavouring to prevent danger arising from want of water, I have sought for a method of making it known, in preference to any apparatus for supply; because I believe it to be of far more importance to *know when* a deficiency occurs, and how long it remains, than to depend upon any method of supply however excellent in itself. The best of pumps, and other apparatus for the same purpose, may, and do, get out of order, and the difficulty is not to repair *them*, but to ascertain *when* they cease to act. When such is the case, and an engine is in full operation, a very few minutes are of immense

* See Journal Franklin Institute, vol. iv. p. 179.

importance in obtaining a knowledge of the fact, because the approach and increase of danger, then keep pace with the consumption of the steam.

One of the chief obstacles to overcome in attempting to ascertain the true line of the water's surface is from the agitation of the water. Glass tubes have been used to expose it to the sight, but there is a difficulty in keeping them sufficiently clean for that purpose, and they are very liable to fracture. Besides, unless the water be at rest, the apparent line in the glass may be very different from the true level of the great bulk of the fluid.

To the same cause may be attributed the inaccuracy to which gauge cocks are occasionally liable: more especially when inserted through the top of a boiler, or when turned down after entering the sides, portions of water being constantly thrown up into their tubes, and expelled by the steam when they are opened.

Should the tube recommended, (fig. 1, p. 366, vol. ix.) answer the purpose of lessening or destroying the ebullition as supposed, gauge cocks will afford more certainty in their operations.

Floats have been much used in stationary engines, and have been recommended for boilers in steam-boats, but there are too many defects in them as ordinarily used, to permit their being safely relied upon. Their form is defective. The solid float requires to be balanced outside of the boiler, which makes it too complex, and renders it more liable to derangement. The hollow metallic floats are in danger of being collapsed. Both kinds are clogged with the stuffing box, which is sufficient to destroy all accuracy in them. And should a valve be used as recommended by Mr. Cassedy, page 98 of volume ix. the pressure of the steam on the area of the valve would prevent it from being opened. The water might subside, and leave the float suspended in the steam, should the tension of the steam, and the area of the valve, be sufficiently great. I fell into this same error, as may be seen p. 236, vol. vi. Journal of Franklin Institute, fig. 2, which could not pass through Dr. Jones' hands without immediate detection.

The great object in a float, is to make known the least decrease of water, in the shortest possible time after it has occurred. To accomplish this, much depends on the form given to it. That its ordinary form is not the best adapted to this purpose, will be evident from what follows. The solid floats of Bolton and Watt, and, so far as I know, of all others, are in the form of a rectangular prism: their upper and under surfaces being equal, and their sides at right angles to them. Let a float of this description, say twelve inches square, and six inches deep, be properly adjusted to a boiler; and suppose the water to subside one inch below its upper surface, it will then have 144 cubic inches of its contents above the fluid, and its weight consequently increased by that of the same quantity of water: that is, it will preponderate, (deducting friction, &c.) with a force equal to the weight of so many cubic inches of water. Now let another float of the same solid contents and *perpendicular depth* as the above, be made in the form of an inverted cone, (the diameter of its base would

be 23.5 inches,) then let the water subside one inch below its surface, and the contents of the frustum exposed above the fluid, would be 360 cubic inches; consequently, it would preponderate with a force compared to that of the other as five to two; that is two and a half times as great, or, it would have the *same power* to make known a deficiency *before* the water had subsided *one half* the distance. *And this advantage of the cone will apply to all floats, solid or hollow, and whether their specific gravities be greater or less than that of the fluid in which they rest.*

It does appear that if a float could be made, without being subject to the evils before mentioned, it would prove as perfect an indicator of a deficiency of water, as any other apparatus yet devised. The following is a description of one designed to obviate those evils. It is the result of much mental and manual labour, and has consumed the greatest portion of my time for the last two years. I have had it in use for the last ten months, and its accuracy has far exceeded my anticipations. It has never once failed in making known the height of the water when at a certain point, and I do not believe the water can subside one-fourth of an inch below that point without the fact being made known by it, and *that whatever may be the tension of the steam in the boiler.* We work the steam ordinarily at 70 lbs. on the inch. The hydrostatic valve is placed on the same boiler, and is constructed to blow off at 80 lbs.

The committee will be able to judge how far I am under the influence of that partiality to their own productions common to inventors. They will also perceive how far this device is applicable, (if at all,) to boilers in steam boats. I think it could be usefully introduced in those that navigate smooth waters, (if not in all,) as it is not subject to the agitation, or swinging motion of the common float.

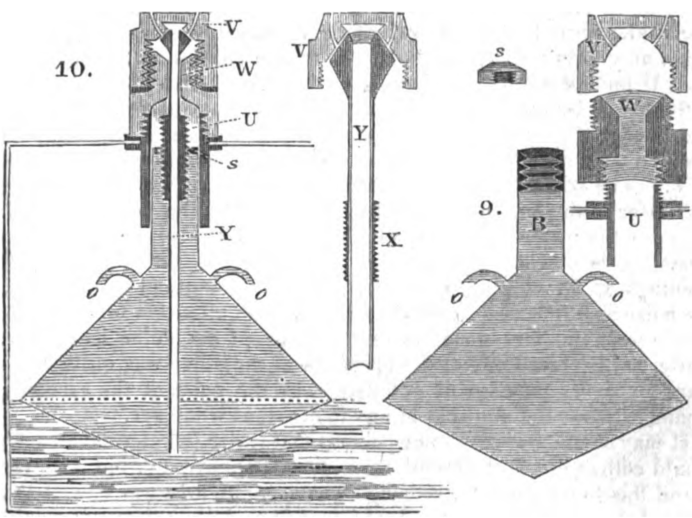


Fig. 9, is a section of the float, being a double cone, that is, two cones united at their bases, made of thin sheet copper. The lower one being the float proper, the upper one terminating in the tube B, which has a female screw formed at its end: *o o* are two short bent tubes, to preserve a communication between the steam in the boiler and the interior of the float; they are preferred to mere holes, as they prevent mud, &c. from falling into the float when thrown up by the agitation of the fluid.

U, is a tube six inches long and two in diameter, securely fixed on the top of the boiler, four inches of its length being inside, and the rest outside of the boiler; a screw is formed on the latter part. The neck of the float or tube B is made to move easily in U, which thus serves as a guide. Y, is a tube rather longer than the depth of the float; a screw four or five inches long is formed on it at X, which fits into the corresponding screw on the neck of the float: a sufficient length is given to X, to adjust by it the float to the required surface of the water in the boiler. S, is a nut to screw on X, close to the top of the float, after it has been united to the latter, to steady them; a collar may be placed between them, to make them steam tight, though this last is not necessary. The lower end of Y reaches to within half an inch of the lowest part of the float. Its upper end is formed into a valve, which is ground air tight to its seat at V; it is made a little spherical to admit of the small motion or play of the neck of the float in U: in the centre of the valve seat, or the part ground, are drilled two small holes, half an inch in diameter, through which the steam escapes, when the valve opens, by the sinking of the water, thus giving notice of the fact.

W, is made to screw on U as represented, it serves as a guide to the part of Y above X: its upper part is formed to receive the under side of the valve, which may be ground to fit it, (the die is not essential,) so that when the valve is opened, *all* the steam which escapes may pass through the float. It is also conveniently separated from U for the purpose of altering or adjusting the depth of the float in the boiler by means of the screw X. The committee will perceive that the pressure of the steam against the valve, is neutralized by its pressing equally (through the tube in the float,) against the valve *seat* at V. The whole of the parts are represented together in fig. 10; the water in the boiler being as high as required, the valve is closed. Suppose the water to subside half an inch, the valve opens and the steam escapes through the float, up the tube Y, and through the small openings at V. I placed over V, a trumpet mouthed organ pipe, the noise of which was so great as to draw the attention of people in the street, (190 feet distance,) who supposed the boiler had burst. I afterwards closed one of the openings as the other was quite sufficient for every purpose of a tell-tale, by the noise of the escaping steam, without the addition of any instrument whatever.

It may be supposed by some persons that water (condensed steam,) would collect in the float and so destroy its buoyancy, but I never found this to be the case, although I have frequently unscrewed W, and taken out the tube Y: indeed, were it to collect there, it would

open the valve by its weight, and be expelled by the steam. This, however, never took place but twice, both of which times the feeding pump had been suffered to work until the water had risen nearly to the small tubes *o o*, when of course it entered the float, but gave immediate notice of the excess of water, by being expelled through the openings at V.

The agitation of the water, has little or no effect on this float; this, however, may be owing to the small size of the boiler and engine. The valve is never opened until the water is on the verge of its prescribed limits, when the valve will alternately open and close, perhaps twice, in the space of a minute, thus giving notice of the approach of a decrease of water. In such cases, a few, say six to eight, strokes of the pump will silence it. After the valve is completely opened, fifty strokes of the pump invariably close the valve. The boiler, as before mentioned, is twenty feet long, and two feet in diameter. The diameter of the feeding pump is two and three-eighths inches, and the length of its stroke six and a half inches. These dimensions, taken in connexion with the facts stated above, show the very small decrease in the depth of the water in the boiler which is made known by this float. The committee will perceive that the float cannot sink more than one half an inch whatever may be the decrease of water in the boiler, as its lower part rests, when opened, that distance upon the corresponding part of W. That distance for the valve to open is abundantly sufficient. The valve itself is only five-eighths of an inch in diameter.

I have made many other floats during the last three years, but this embraces the best features of them all; it is therefore unnecessary to describe them at present.

The last cause of explosions mentioned in the commencement of this paper is neglect. Perhaps every thing that could be said on this subject, has been anticipated in those communications already published by the committee, I therefore pass to the consideration of the means proposed for confining the effects of an explosion to the vicinity of the boiler itself.

For this purpose bulk heads have been strongly recommended. Perhaps they could not be made to impart equal security, to take up less room, &c. better than in the form of an extra boiler, or strong cylindrical casing of iron, inclosing the boiler proper, with a certain space between them. When boilers are placed fore and aft, and on the guards, the end of this casing might be left open. This plan would have important advantages which no bulk heads could possess. The space between it and the boiler, would allow for the expansion of the steam in case of explosion, and by its cylindrical form, the effect would, in a manner, be isolated, and so prevented from expending its energy against the boat. I have no doubt, however, that a steam-boat may be made quite secure without either of these devices.

The different subjects proposed to be embraced in this letter, have now been discussed. I shall be much gratified should my communication contain any thing calculated to prevent explosions, or to increase our confidence in the use of the steam engine, that "noblest work of man." THOMAS EWBANK.

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, *to ascertain, by experiment, the value of Water as a Moving Power.*

(Continued from p. 377, vol. ix.)

WHEEL NO. III.

The diameter of this wheel was ten feet. The wheel having been substituted for No. II. and the necessary alterations made in the apparatus, the friction of the wheel and drum was examined, and ascertained to be, in each, one per cent. of the weight applied.

The differences of weight which were applicable to the experiments with the larger wheels, would have been too considerable for that under consideration. Variations were made occasionally of fourteen pounds, and usually of twenty-eight, or fifty-six pounds; the leads of 103 lbs. were sometimes used to make up a considerable weight. With small apertures it was found necessary to remove the leads which in the former experiments were contained in the iron basket. The friction table will, therefore, contain instead of the usual constant resisting weight the weight when the leads were removed, and the additional friction for fifty-six pounds, from which that for the different weights is easily obtained.

The weight raised by this wheel was never sufficient to suspend the shaft.

Constant *inactive* weight.		
Weight of the wheel, - -	1600 lbs.	
Weight of that part of the chain which was between the barrel of the shaft and the drum,	264 "	
Weight of the drum, - -	200 "	
Total, - - -	2064 lbs.	
Friction upon this at one per cent. -		20.64 lbs.
Constant *resisting* weight.		
That part of the chain which was between the barrel of the shaft and the ground, -	20 lbs.	
Weight of the iron basket, - -	126 "	
Total, - - -	146 lbs.	
Friction upon this at one per cent. -		1.46 lb.
Friction from *constant weight,* - -		22.10 lbs.
The centre of gravity of the water upon this wheel, (see Fig. 3, Plate V.) was 3.02 feet from the axis, and the barrel about which the chain was wound was one foot from the same axis; hence to raise 146 lbs. and overcome a friction of 22.10 lbs., the constant friction just found, required a weight of water of -	55.66 lbs.	
Friction due to this at one per cent. -		.56 lb.
Total amount of friction when the weight raised was 146 lbs. - -		22.66 lbs.

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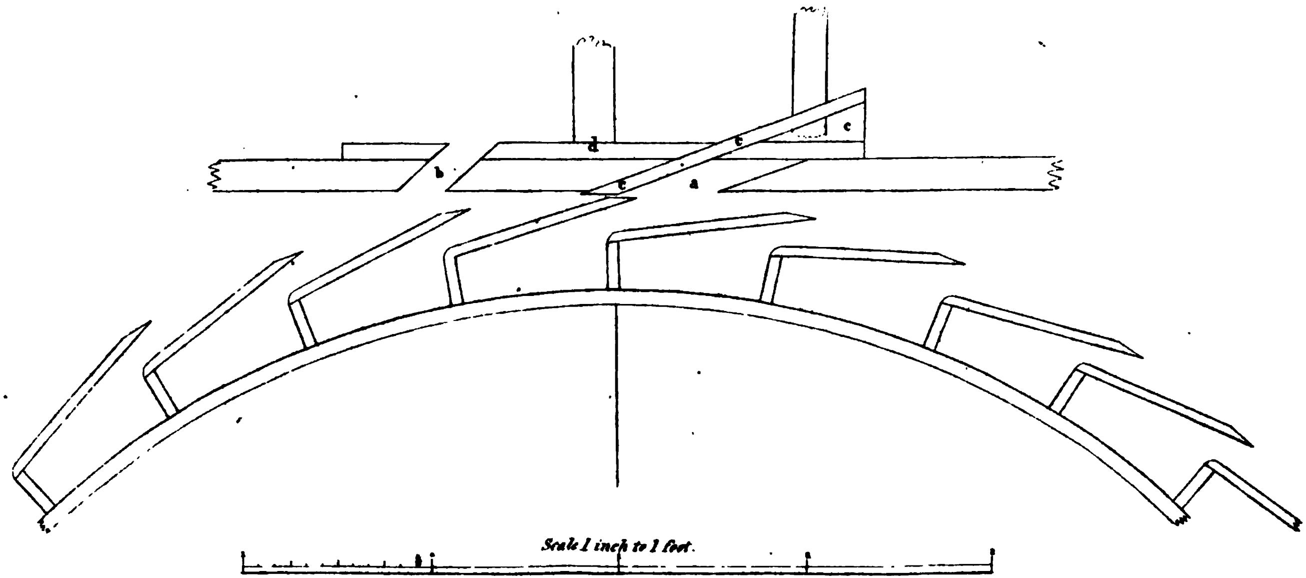

Scale 1 inch to 1 foot.

Additional friction for every 56 lbs.

Weight, - -	56.00 lbs.
To balance this weight and its friction, or 56.56 lbs. required, at 3.02 feet from the axis, a weight of water of - -	18.73 "
Total, - - -	74.73 lbs.

Friction upon this weight at one per cent. .75 lb.

The details in relation to wheel No. III. were as follow.

The diameter of the wheel was ten feet, the breadth twenty inches, being sixteen inches in the clear between the cants which were six inches deep.

The buckets applied were of the elbow form, the depth being twelve and one quarter inches, the width of elbow three inches, and the opening at the throat two inches. The number of buckets was thirty-four.

There were no air vents in the buckets.

This wheel was used only as an overshot wheel. Two chutes were placed near the top of the wheel, (see Plate VII.) They were so situated in relation to each other, that when a bucket had just ceased to receive water from the one, it began to receive the water discharged by the other. The inclination of each chute to a tangent to the wheel, drawn through the point at which one side of the chute if produced would cut the periphery of the wheel, was the same. The object of providing the two chutes, was to determine the relative effects of one aperture of a given area, and of two apertures the sum of the areas of which should be equal to the area of the first, all other circumstances being the same. These experiments were suggested by observing that the narrow throat of the elbow buckets prevented their filling in the time of passing one chute, the air in the bucket having no other vent than the passage through which the water entered.

The gates used at these chutes are represented in Plate VII, where *a* and *b* are the chutes, and *c* and *d* are the sliding gates closing the chutes. The dimensions of the parts will be seen from the scale attached to the drawing.

A reference to the tables will show that this wheel was used both with and without a breast, and that in each case the general order of the experiments was similar to that followed in the cases of the other wheels.

The breast extended to the height of three feet and a half above the lowest point of the wheel.

The tables will be designated by the Roman numerals. The experiments made with the wheel close to the breast will be contained in table I, parts 1, 2, and 3. Those with the wheel removed from the breast in table II, parts 1 and 2.

Under the heading " Width of aperture," will be found two columns for the purpose of entering the widths of opening when both the chutes were used.

The height through which the weight was raised, as in wheel No. II, was exactly forty feet.

TABLE I.—PART 1.

WHEEL No. III.—*Elbow Buckets. Close Breast. Water let on at top of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture a	b	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Observations.
	Feet	Feet	Feet	In.	In.	Pds.	Pds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.					
1	0.25	0.50	1.10		1.50	146	22.67	168.67	40.0	31	6.13	800	10.5	84000	67468	.803		
2						174	23.04	197.04		39	4.87	925		97125	78816	.811		
3						188	23.22	211.22		42	4.52	985		103425	84488	.817	.817	
4						202	23.41	225.41		46	4.13	1055		110775	90164	.813		
5						257	24.14	281.14		54	3.52	1330		139650	112456	.805		
6	0.75	1.00	1.60		1.50	257	24.14	281.14	40.0	27½	6.91	1290	11.0	141900	112456	.792		
7						313	24.88	337.88		34½	5.51	1550		170500	135152	.792		
8						341	25.25	366.25		36½	5.20	1645		180950	146500	.809	.809	
9						388	25.87	413.87		41½	4.57	1900		209000	165548	.792		
10	1.75	2.00	2.60		1.00	257	24.14	281.14	40.0	26	7.31	1255	12.0	150600	112456	.746		
11						285	24.51	309.51		27	7.04	1370		164400	123804	.753		
12						313	24.88	337.88		27½	6.91	1500		180000	135152	.751		
13						341	25.25	366.25		32	5.94	1610		193200	146500	.758	.758	
14						360	25.51	385.51		33	5.78	1710		205200	154204	.751		
15						388	25.88	413.88		34½	5.69	1845		221400	165532	.747		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE I.—PART 2.

WHEEL No. III.—*Elbow Buckets. Close breast. Water let on at top of wheel.*

No. of Exper't.	Head of Water above.			Width of Aperture		Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.	a.	b													
	Feet.	Feet.	Feet.	In.	In.	Pds.	Pds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.					
16	2.75	3.00	3.60	0.50	0.50	285	24.51	309.51	40.0	26½	7.18	1315	13.0	170950	123804	.724	.724	
17						299	24.69	323.69		28	6.79	1380		179400	129476	.721		
18	2.75	3.00	3.60	0.56¼		257	24.14	281.14	40.0	22½	8.45	1245	13.0	161850	112456	.695		
19						285	24.51	309.51		25½	7.45	1315		170950	123804	.724	.724	
20						299	24.69	323.69		28	6.79	1390		180700	129476	.716		
21	2.75	3.00	3.60	0.62½		271	24.33	295.33	40.0	24	7.91	1305	13.0	169650	118132	.696		
22						285	24.51	309.51		25	7.60	1335		173550	123804	.712		
23						313	24.88	337.88		26½	7.18	1445		187850	135152	.719	.719	
24						341	25.25	366.25		30	6.33	1570		204100	146500	.717		
25						360	25.51	385.51		30	6.33	1660		215800	154204	.714		
26						402	26.05	428.05		33	5.78	1870		243100	171220	.704		
27	2.75	3.00	3.60		0.75	202	23.41	225.40	40.0	21½	8.84	1075	13.0	139750	90164	.645		
28						230	23.78	253.78		24½	7.76	1125		146250	101512	.694		
29						257	24.14	281.14		25½	7.45	1240		161200	112456	.697	.697	
30						285	24.51	309.51		28	6.79	1370		178100	123804	.695		
31	2.75	3.00	3.60		1.00	341	25.25	366.25	40.0	26½	7.17	1675	13.0	217750	146500	.672		
32						374	25.69	399.69		30½	6.23	1800		234000	159876	.683		
33						388	25.87	413.87		30½	6.23	1855		241150	165548	.686		
34						402	26.05	428.05		31	6.13	1910		248300	171220	.689	.689	
35						430	26.42	456.42		33	5.78	2050		266500	182568	.685		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE I.—PART 8.

WHEEL No. III.—*Elbow Buckets. Close Breast. Water let on at top of Wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture a	b	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Observations.
	Feet.	Feet.	Feet.	In.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.					
36	3.75	4.00	4.60	0.37½		257	24.14	281.14	40.0	24	7.92	1185	14.0	165900	112456	.678		
37						285	24.51	309.51		25½	7.60	1290		180600	123804	.685	.685	
38						299	24.69	323.69		27	7.04	1365		191100	129476	.678		
39	3.75	4.00	4.60	0.37½	0.25	313	24.88	337.88	40.0	24	7.92	1505	14.0	210700	135152	.641		
40						341	25.25	366.25		25	7.60	1590		222600	146500	.658	.658	
41						388	25.88	413.88		25	7.60	1815		254100	165652	.652		
42	3.75	4.00	4.60	0.50		285	24.51	309.51	40.0	24	7.92	1320	14.0	184800	123804	.670		
43						313	24.88	337.88		23	8.26	1425		199500	135152	.677		
44						341	25.25	366.25		27½	6.91	1530		214200	146500	.684	.684	
45						355	25.43	380.43		26½	7.18	1625		227500	152172	.669		
46	3.75	4.00	4.60		0.62½	257	24.14	281.14	40.0	28	6.79	1275	14.0	178500	112456	.631	.631	
47	3.75	4.00	4.60		0.75	257	24.14	281.14	40.0	22	8.64	1310	14.0	183400	112456	.613		
48						285	24.51	309.51		24½	7.92	1360		190400	123804	.650		
49						313	24.88	337.88		26½	7.18	1440		201600	135152	.670	.670	
50						341	25.25	366.25		29	6.44	1575		220500	146500	.664		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE II.—PART 1.

WHEEL NO. III.—*Elbow buckets. Without Breast. Water let on at top of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture a	b	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Observations.
	Feet.	Feet.	Feet.	In.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.					
1	0.25	0.50	1.10	1.50		146	22.66	168.66	40.0	38	5.00	960	10.5	100800	67464	.669	.669	
2					1.50	146	22.66	168.66		42½	4.47	1000		105000	67464	.642		
3						174	23.04	197.04		48	3.96	1125		118125	78816	.667		
4						188	23.22	211.22		50	3.80	1200		126000	84488	.670	.670	
5				0.75	0.75	188	23.22	211.22		42½	3.80	1175		123375	84488	.684		
6						216	23.59	239.59		55½	3.80	1320		138600	95836	.692	.692	
7	0.75	1.00	1.60		1.50	216	23.59	239.59	40.0	25½	7.55	1160	11.0	127600	95836	.751		
8						257	24.14	281.14		29½	6.44	1350		148500	112456	.757		
9						285	24.51	309.51		32½	6.04	1450		159500	123804	.776		
10						313	24.88	337.88		34½	5.51	1575		173250	135152	.780	.780	
11						341	25.25	366.25		37	5.13	1725		189750	146500	.772		
12				0.75	0.75	285	24.51	309.51		31	6.00	1490		163900	123804	.755		
13						313	24.88	337.88		32	5.94	1620		178200	135152	.758	.758	
14	1.75	2.00	2.60		1.00	257	24.14	281.14	40.0	25½	7.55	1310	12.0	157200	112456	.715		
15						313	24.88	337.88		33	5.78	1550		186000	135152	.726	.726	
16						360	25.51	385.51		34½	5.51	1800		216000	154204	.714		
17				0.50	0.50	360	25.51	385.51		31½	5.43	1705		204600	154204	.754	.754	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table II.—Part 2.

Wheel No. III.—*Elbow Buckets. Without Breast. Water let on at top of Wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture a	b	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Observations.
	Feet.	Feet.	Feet.	In.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.					
18	2.75	3.00	3.60		1.00	360	25.51	385.51	40.0	29	6.55	1775	13.0	230750	154204	.668	.668	
19	2.75	3.00	3.60	0.50	0.50	360	25.51	385.51		26½	7.17	1690		219700	154204	.702	.702	
20	3.75	4.00	4.60	0.75		341	25.25	366.25	40.0	22	8.45	1600	14.0	224000	146500	.654	.654	
21	3.75	4.00	4.60		0.75	360	25.51	385.51		33	5.68	1825		255500	154204	.604	.604	
22	3.75	4.00	4.60	0.37½	0.37½	360	25.51	385.51		30	6.33	1625		227500	154204	.678	.678	
23						341	25.25	366.25		27	7.04	1570		219800	146500	.667		
24	3.75	4.00	4.60	0.50		257	24.14	281.14		21	9.05	1300		182000	112456	.618		
25						285	24.51	309.51		22	8.64	1400		196000	123804	.632		
26						313	24.88	337.88		24½	7.76	1470		205800	135152	.656		
27						341	25.25	366.25		25½	7.45	1550		217000	146500	.675	.675	
28						374	25.69	399.69		25	7.60	1725		241500	159876	.662		
29	3.75	4.00	4.60	0.37½		257	24.14	281.14		25	7.60	1210		169400	112456	.664		
30						285	24.51	309.51		24	7.92	1300		182000	123804	.680	.680	
31	3.75	4.00	4.60	0.37½	0.25	313	24.88	337.88		24	7.92	1485		207900	135152	.650	.650	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

[TO BE CONTINUED.]

TO THE COMMITTEE ON PUBLICATIONS OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Reply to the further remarks of Mr. Espy on the application of water upon wheels.

Gentlemen,—In the number of this Journal for May last, (No. 5, vol. ix.) are contained certain remarks by Mr. J. P. Espy upon my notice of a critique made by him upon a paper over the signature "L. M." In the course of his remarks Mr. Espy has *conditionally* corrected what I then pointed out as an error which his critique upon "L. M." contained. The condition is, that the "supposition" be erroneous "that water, or any other heavy body, produces the same mechanical effect by moving with a uniform velocity downwards the same distance whatever its velocity may be:" he does not show, however, nor am I able to perceive, how the truth of this supposition (which I hold to be undeniable,) can be made to sustain what he then stated in effect, viz. That when the "velocity of water in the required direction is five and a half feet, immediately on striking the wheel it receives an additional velocity of six and a half feet by a force due to a head of eight inches." I therefore assume that he has not admitted and corrected the error into which I supposed he had "*inadvertently* fallen."

Mr. Espy's mode of using time, instead of space, as an element in his calculations, does not appear to me to be correct, and I must, therefore, reject as erroneous the result at which he arrives, viz. that the whole loss of power will be forty-one inches. On the contrary, if it be admitted that when the water strikes the soaling at an angle of forty-five degrees, the motion (five and a half feet,) in the direction of the radius of the wheel is destroyed, "L. M.'s" calculation would be right. The result of this calculation is a loss of head of thirty-three and one-third inches, instead of forty-one inches as given by Mr. Espy. I do not, however, admit the destruction of the whole of the velocity in the direction of the radius of the wheel, and will endeavour to show that it is *chiefly* changed to the direction of the tangent.

Mr. Espy says, "if we suppose the water and the soaling both perfectly elastic, the water upon striking the soaling would rebound, making the angle of reflection equal to the angle of incidence; and the velocity in the direction of the tangent would evidently remain the same. If we suppose the water and the soaling both perfectly hard and smooth, upon striking the soaling, the motion of the water in the direction of the radius of the wheel would be entirely destroyed, whilst that in the direction of the tangent would remain the same." The first of these propositions I fully admit; but, as the water does not possess the property of perfect elasticity, the angle of reflection will not be equal to the angle of incidence. The last proposition I will neither affirm nor deny, inasmuch as having no materials which are perfectly hard, no experiments have been, or can be made, to prove what would be the result if such materials could be found and

used for the purpose. But I admit that, if instead of the water and the wheel, solid and non-elastic substances, such as do exist, however hard, (none being so hard as to resist a change of form on collision,) were used, the motion in the direction of the radius would be destroyed, and that in the direction of the tangent remain the same. This destruction of motion, however, cannot be effected without the result of a change of form of one or both of the substances thus brought into collision, and the quantity of power expended in the change, will be equal to the quantity of motion or power destroyed. For example, suppose a leaden ball of two pounds be let fall from a height of 100 inches on a hard* non-elastic horizontal plane, and the lower side of the ball be indented, or bruised, so that its mass be brought one inch nearer the plane than where it first struck, the space through which the mass would have passed after contact, would, of course, be one inch, the mean degree of the force of collision would be found as follows: as 100 inches, the distance through which the ball descended, is to two pounds, the force by which it was impelled, so is one inch to 200 pounds, the medium force by which the ball would have been resisted in its collision with the plane; and in like manner if a similar ball be projected against the soaling of a wheel supposed to be hard and non-elastic, the figure of the ball would be changed, and the *quantity* of resistance in the change would be equal to the *quantity* of motion or power destroyed. The result will be very different, however, if water be used instead of the leaden ball, which must be apparent to every person of the slightest observation. Suppose two pounds of water be let fall upon a plane; portions of it will be driven off nearly in the direction of the plane, radiating from the point of impact, at a velocity but little diminished: this velocity must be derived from, or rather is a part of, the original motion, the direction of which has been changed by striking the plane. Had this been a perfectly elastic body it would have rebounded perpendicularly to the height from which it originally fell; had it been a leaden ball its particles would have been prevented by cohesion from flying off, as in the case of the water, consequently its whole motion would have been destroyed by the change of figure, or, in other words, by friction occasioned by the particles pressing upon each other with great force in this movement among themselves. With regard to the water, although its original figure suffers a greater change, yet the frictions *consuming the motion* are diminished, the particles being pressed with less force against each other. Thence, in the case of the lead, the motion was all destroyed, and only part of it in that of the water; what remains in this latter case would, of course, be capable of producing mechanical effect.

This explanation applies to the action of the wheels at Fair Mount, which receive the impulse of the water at an angle of forty-five degrees. We are, therefore, not to expect the motion in the direction of the radius of the wheel to be wholly destroyed, but on the contrary only a small portion of it, because the water will be less agi-

* Hard, is here used comparatively.

tated, or, what is the same thing, the particles will be less moved among themselves than in the case where it fell perpendicularly upon a plane. Thus the water will move off nearly in the direction of the tangent with no other loss of motion than that occasioned by a comparatively small agitation. It is evident, then, that a change of direction, without a corresponding destruction of motion, is not repugnant to any law of nature, and that when it cannot be effected without loss, it must be attributed to the materials made use of, or to the manner of applying them.

Having, as I believe, shown with sufficient clearness that a change of direction may take place under the circumstances in which water is used at Fairmount, without a proportionate loss of motion, it is deemed unnecessary to extend this paper in review of Mr. Espy's deductions from the known laws of action and reaction, &c. His proposition for substituting time instead of space, as an element in determining the power of water, is to me so mystical, that I confess I cannot, or rather, that I have not yet been able to, understand his illustrations in support of it, and must therefore pass it by for the present.

I would be indulged in a few observations upon a subject introduced by Mr. Espy. This subject refers to a former controversy regarding the laws of momentum, in which Mr. Espy maintains, that momentum is proportional to the velocity of a body, and not proportional to the square of the velocity, for which latter law he says I contended.

It will be necessary first to state that I understand the word momentum, to mean the power or capability of a body in motion to produce a mechanical effect by virtue of that motion. For example, if a heavy wheel be in motion, its power to raise a weight by means of a cord connected with its axis, I deem to be the measure of its momentum, the quantity of which may be found by multiplying the weight by the height through which it has been raised. This supposes the wheel to be free from all other resistances. If Mr. Espy's understanding of the term be different from this, our difference in opinion may relate to the meaning of the word momentum alone. With this explanation, I will proceed to apply the theory for which Mr. Espy says I have contended, to a case which he appears to rely upon with the utmost confidence as conclusive in support of a different one. He says, "let two non-elastic bodies, of different masses, meet each other in opposite directions, with velocities inversely proportional to their masses, the momentum of each will be destroyed, for after the stroke there will be no motion." The principle of action here is identical with that of the leaden ball noticed above, and the quantity of power destroyed by the collision is to be found by multiplying the space through which the bodies pass respectively whilst in collision, by the degree of force by which they resist each other. Suppose the masses in motion, and their velocities inversely, to be as one to two, and the velocity of the smaller body to be sixty-four feet, and that of the larger body thirty-two feet per second; then according to the second theory above stated, the momentum of the first may be thirty-two, and the latter sixteen. Suppose that in the

collision they bruise each other so that the centre of their masses be brought three inches nearer to each other than their unaltered form would have admitted, their united momentum, after collision, will be less than before collision by the effect due to a resistance acting through three inches of space, and as "action and reaction are equal," both will be resisted by precisely the same degree of force, but as the smaller body moves with double the velocity of the larger, and both come to rest at the same instant, the first will pass through two inches, the latter through but one inch, after they come in contact. The mean degree of force will be sixteen, which, multiplied by the space two inches, give thirty-two as the quantity of resistance which brought the smaller body to rest, and the larger body being resisted by the same degree of force, to wit, sixteen multiplied by one, the space through which it was resisted, the product is sixteen, which is the momentum destroyed in the large body. As this result appears to be at variance with Mr. Espy's notion of the equality of action and reaction, which is true in *degree*, but not in *quantity*, it may be further illustrated by a very familiar case.

Suppose a gun be discharged, projecting a ball with a momentum capable of perforating a plank two inches in thickness, I believe it will not be contended by any that if a similar ball were attached to the breech of the gun in such manner as to be forced by its recoil against a similar plank, that the latter also would be perforated. The law here is the same as in the case of the smaller and larger bodies noticed above, the action of the powder on the ball would exert a force reacting in an opposite direction and equal in *degree* against the gun, but the *quantity* of force that would be communicated to each, will be as the force multiplied by the space through which the ball and the gun would respectively pass, whilst the force of the powder continues to act on either.

Very respectfully, yours, &c.

C.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.*

On the method of Embalming by the Egyptians, and the Preservation of Dead Bodies from Decay.

It is an established fact in the history of science, that the Egyptians were the first people to rear up the fair temple of knowledge for the abode of those abstract and interesting studies which even at the present day remain sealed to the larger portion of mankind. The sciences of astronomy, the yet more subtle pursuit of astrology, architecture, painting, and medicine, connected with some portion of practical chemistry, were undoubtedly pursued with an avidity as surprising as they were prolific of discovery: and posterity acknowledges the wondrous strength of mind that could force intractable materials to a common purpose, without the aid of the extraordinary adaptation of power which is at our command. It would be an in-

* Addressed to the Committee on Publications, and by them inserted.

teresting task to explore the route of science by the Egyptian way; to track the god-like spirit of intelligence through an æra, dreary and darkened in other respects by the errors of superstition; to follow the beams that emanated from one celestial principle, guiding the will through mazes of doubt, until the light of science burst upon the view; and it would be equally instructive to institute comparison between an ancient and a modern literature, with an intention of ascertaining how far we have retrograded in some instances, and how far we have in others advanced in the pursuit of many of the sciences, and in the cultivation of many of the arts: but, under the title of these remarks, we may not extend our researches beyond the limits of our inquiry, nor is it necessary for the confirmation of the assertion of the skill of the Egyptians, since that one inquiry will display it, not only in a remarkable, but in an inimitable degree. We allude, of course, to the method pursued by that nation in the preservation of their dead by the process of embalming.

It was the belief of the Egyptians that the soul was eternal, but that after the death of the body, it migrated into the various tribes of beings in the earth, air, and water, and once more returned, after an absence of three thousand years, to animate the structure of man. The first change was believed to take place only when the process of corruption was complete, the soul remaining attached to the frame in a state of somnolence so long as the remains of humanity were visible; from this supposition arose the idea of preserving the body from putrefaction for an indefinite period, in order to chain the soul, as it were, to its former abode, and render its flight to other receptacles less rapid, and its changes of less variety. Thus no expense or exertion was spared to stay the progress of putrefaction, no labour withheld in the erection of those majestic fabrics destined for the reception of the bodies yet presumed to retain the silent spirit; and the fortunes of survivers were readily bestowed in the completion of what were termed eternal mansions, while their own dwellings, denominated inns, or resting places, from the short sojourn of the travellers within them, were left comparatively unadorned.

Upon the decease of a person of consequence, the females of his household, and his acquaintances, covered their heads and faces with clay, bared their bosoms, and girt their waists with coarse cloths, and, leaving the body in the dwelling, perambulated the city, uttering loud cries, bewailing the loss of the dead, and describing his qualities, at the same time violently beating their persons. The men, in like manner, formed another company, and pursued a similar mode to testify their grief, all rigidly abstaining, until the interment of the corpse, from the use of the bath, from wine, from the better descriptions of food, and the use of fine apparel. The body was, in the course of a few days, removed to the embalmers, who having performed their office, returned it to the relatives. It was then placed in a coffin of a shape like the human figure, and in general placed upright in the receptacle designed as a tomb. Sometimes by the exercise of a singular species of piety, the corpse was kept in the dwelling of the surviving friends, in a magnificent apartment, prepared

for its reception, and in some instances, the embalmed body was carried as a guest to the tables of friends.

We are told by Herodotus and Diodorus Siculus that the art of embalming was practised in three different modes; the first, required only in preserving the bodies of kings or nobles of the highest rank, cost a talent of silver,* and was thus conducted. The brains were first drawn out through the nostrils by a curved instrument, and the cavity filled with spices. An officer, termed a Scribe, then drew a line on the left side of the abdomen, where an incision was to be made, which was exactly followed by a menial called the Paraschistes, with a sharp Ethiopian stone; this done, he immediately retired to avoid the execrations and violence of the bystanders, who sought in this manifestation of their indignation to ward off the curse which they presumed to await them in permitting a wound to be inflicted upon a dead body.

The office of the embalmers now commenced; one of them thrusting his hand through the wound, drew out the intestines, leaving the heart and kidneys. The abdomen was then filled with pounded myrrh, cassia, and other sweet smelling drugs, frankincense alone excepted, and the incision being closed, was carefully sewed up; the body was immediately rubbed over with oil of cedar, and other preparations, for thirty days successively, or otherwise it was soaked in a strong solution of nitre for seventy days, the longest time allowed for the preparation of the body. At the expiration of this time, the body was carefully washed, and wrapped round with strips of fine linen in every part, which was afterwards covered with a gummy substance.

These arrangements were all performed with the utmost nicety, the hair of the head and the eyebrows were uninjured, and even the features so little disturbed as to permit the recognition of the individual years after his embalmment, in those cases where he was detained from the sepulchre. The second mode was much more simple, and consisted in injecting oil of cedar into the bowels, by the rectum, retaining it there, and placing the body in a solution of nitre, as before, for seventy days; the injection was then allowed to escape, bringing with it the entrails, which the oil had in a great measure consumed. The body was then delivered to the friends without any further preparation.

The third method, which was adopted for poor persons, consisted in merely injecting into the stomach and bowels some preparations of less value than the oil of cedar, and soaking the body in a nitrous solution.

The coffins, or cases, in which were put these preserved bodies, or mummies, as they are styled by the Arabs, and from whom we have borrowed the term, were usually made of sycamore wood, which possesses extraordinary durability; the top was formed in the shape of a human head, with a face painted thereon, resembling that of a female: the trunk was one continuous piece, made very thick, with a

* About $1100.

broad pedestal at the bottom, to enable it to stand upright in the tomb. In some few instances, a stone coffin has been discovered, presenting the same shape, and, in still rarer cases, the covering of the body has been found of cloths gummed or fastened together, and constructed in the usual form.

Upon the examination of a mummy, we find it wrapped in a shroud of linen, or rather a finer fabric than canvass, upon which are secured scrolls of the same material, painted with a variety of characters, and generally running down the centre of the body and sides, or placed on the knees or legs: the head is fitted with a piece of linen, the feet have likewise a similar covering, painted with hieroglyphics, and fashioned in the form of a high slipper. The whole body is swathed with narrow bands of linen, beginning at the head and ending at the feet, to the almost incredible length of upwards of one thousand ells upon one corpse; and those in particular which cover the head and face are so neatly laid on as scarcely to disguise the shape of the eyes, nose, and mouth.

On the breast, are folds of linen cut in a scalloped form, as if to answer the purpose of a breast plate, and which are usually richly painted and gilt, sometimes bearing the figure of a woman with the arms extended. Within the body are found masses, of the colour, scent, and consistence of pitch, or bitumen, which are readily affected by heat; and upon the examination of one body in England, it is recorded that about two pounds weight of this substance was found in the cavity of the skull. The piece of coin that was supposed to be placed in the mouth of the corpse has been looked for in vain, although a small plate of gold of trifling value has been occasionally discovered under the tongue. The hands are sometimes stretched upon the thighs, but more commonly folded across the bosom; the skin blackened, and usually attacked in some parts by a peculiar kind of coleopteral insect, and the hair perfect.

The heart, and, in some instances, other viscera, are found in a dried but perfect state of preservation, and the whole frame is remarkable for its lightness and rigidity.

An opinion has prevailed that the Egyptians possessed the power of extracting the brain, and filling the cavity with a bituminous composition, without mutilating any of the bones of the skull; but this is hardly practicable.

The nostrils offer the only medium through which the brain could be removed without visible marks of injury, and the delicate structure of the cribriform plate of the ethmoid bone would be destroyed by the application of the slightest violence. In all the examinations witnessed by the writer, a probe was readily passed up the nostrils to the roof of the cranium, proving that the brain had been removed by those channels, and that the delicate bones of the skull had been broken down in the attempt. It will thus be seen how perfect the system adopted by the Egyptians for the preservation of their dead was rendered; their work is before us, unattainable to our execution, existing in its pristine excellence, and capable of yet enduring for an illimitable extent of time. And so of many other pursuits: we

can scarcely conceive the ability that could raise so ponderous a mass as the pyramid of Cheops, which might well be termed an eternal mansion, since it has endured so long with the finger of time laid so lightly upon it, as not to have injured its fair and magnificent proportions: and it is equally difficult to imagine, how, in the dearth of correct knowledge, and the want of scientific material, conclusions could have resulted from observations of heavenly bodies so closely allied to truth, as to have assisted in the construction of a solar system, in some respects resembling that upon which our astronomical calculations are founded.

The art of embalming, as practised by the Egyptians, may be said to have expired with them as an ancient nation. In continental Europe, in England, in Teneriffe, South America, Otaheite, and other islands in the southern ocean, processes have been adopted for preserving dead bodies from decay, and in some situations, the soil in which the body has been placed, has acted as the antiseptic agent in staying the progress of putrefaction. Gough, in his sepulchral monuments of Great Britain, observes, when speaking of embalming, "that Henry 1st, in 1135 was gashed, salted, and sewed up in a bull's hide, after his bowels, tongue, heart, eyes and brains had been taken out." This uncouth mode of embalming appears to have been practised in England for a considerable period, although the hide was soon laid aside in favour of cloth, and sometimes of silk or satin coverings, and to have been especially in request to preserve the bodies of sovereigns, and the higher orders of ecclesiastics. Edward 1st, buried in 1320, and found in a state of tolerable preservation in 1714, is said to have been the first monarch upon whom the practice of cering was tried, an operation performed by the Court chandler, and consisting merely in enfolding the royal body in a waxed cloth or silk, after the removal of the viscera. This custom continues to the present time, and is extended to all the members of the royal family.

The remains of Edward the Confessor; of Fair Rosamond; of Maud, daughter of Henry 1st; of Thomas, Bishop of Ely, who died in 1570, and was examined in 1780; of Humphrey, Duke of Gloucester, died 1100 and examined 1747; of king Charles 1st, beheaded 1648, and examined in 1813; of Henry 8th, likewise examined in 1813, (upon the breaking in of his coffin, when restoring that of Charles 1st to its former situation,) have all been exposed, and in different states of preservation. Some of these bodies have been discovered in a species of spiced wine, and others wrapped up in vestments of different descriptions; but, in general, although the structure be not destroyed by corruption, the means adopted have been insufficient to ensure the regularity of appearance, and the preservation of every portion, so remarkable in the Egyptian process.

There are three other methods, which may be styled natural means of preservation, and by which a human body can be withheld from the operation of the putrefactive process, for a very long period of time.

We are presented with examples of the first mode, by the disco-

very of bodies found in the sands of Arabia, dried by the air, the external cavities filled with sand, and preserved entire, without the assistance of art. Of the second, by bodies found on the sea coast, where from long exposure to the sun, and repeated washings by the wave, they become so dry and hard, as almost to present the appearance of a fossil remain. Of the third, by bodies preserved by the peculiar properties of the soil in which they have been deposited. The circumstances under which bodies are preserved by the first two processes are sufficiently simple, and need no remark, but with the third, an event of some notoriety is connected, having too close a reference to our subject to pass unheeded.

Fourcroy relates "that the burying place 'Des Innocens,' at Paris, was opened for the purpose of removing the bodies of the poor which had been buried there in large graves, each holding from one thousand to fifteen hundred, and about thirty feet deep, and twenty feet wide. Each body was buried in a wooden coffin, and all were arranged one alongside of the other: the pit was generally filled in the course of three years, when it was covered with earth to the depth of about a foot, and in the course of from fifteen to thirty years, it was again opened for the same purpose as before. Upon the opening of these graves, and the removal of the covers of the coffins, the bodies appeared to be flattened or pressed down, a considerable space being left between their surface and the top of the coffin. Those bodies that had been buried for about fifteen years, consisted of a soft grayish-white coloured substance, of a fatty nature, bearing a considerable resemblance to spermaceti, into which every part of the body was converted, except the bones, which, being no longer retained by their former attachments, were separated by the slightest effort, they were also very easily broken, while the muscles, tendons, ligaments, blood-vessels, viscera, &c. were changed into a homogeneous mass; perfectly uniform in its texture. In those instances, when the bodies had only been buried nine or ten years, the form of the different parts was distinctly visible. It is said that this appearance is retained for thirty or forty years, when it is at length decomposed and carried away by the surrounding moisture. According to the prevailing opinion, the skin passes more readily into adipocere than any other substance, and is next followed by the muscles and viscera." After these remarks, it may be observed that when a body is interred in a soil of the nature to accomplish such results, and a large quantity of moist earth is present, the common putrefaction that animal matter undergoes, rapidly takes place, particularly when the temperature is considerable; but if the corpse be placed in a dry situation, where the earth is exposed to the rays of the sun, and becomes quite dry, the fluids are evaporated, and it is converted into a kind of mummy. In the repositories of "Des Innocens," the bodies were excluded from the action of the external air, and left to the spontaneous reaction of their elements.

We have now examined the ancient mode of embalming by the Egyptians, the manner in which bodies were preserved by other nations at a much later period, and the processes adopted by nature in

some cases in preserving her noblest work from decay. There can be little difficulty in awarding the palm of merit, as the productions of all have fallen under the inspection of man; we must confess that the Egyptians infinitely excelled in retaining the semblance of the human form, and in keeping destruction at a distance. We have thus supported the principle with which we started, that in this particular, modern ability is surpassed by the silent testimony of ancient skill.

We shall upon another occasion endeavour to trace the meanings and the references conveyed by the hieroglyphics as appearing on the cases and vestments of Egyptian mummies.

Bibliographical Notices and Reviews.

On the Strength and Best Forms of Cast Iron Beams.

[Continued from p. 389, vol. ix.]

In pursuing the deductions from his experiments our author proceeds to compare together the deflections of beams of the new form under their breaking weights, or, in other words, seeks by comparing the ultimate deflections to determine the law of these deflections when the breadth and length of the beam are varied.

The mode of calculating the ultimate deflections would seem to subject them to errors of variable magnitude; it belongs to experiment to determine whether these may, or may not, be neglected for purposes of practical inquiry.

The method of calculation to which we refer is, to assume the deflections to be proportional to the weights producing them, even up to the breaking weight. Thus, "in experiment 11, 13706 lbs. bent the beam .52 of an inch, and 14462 lbs. broke it. As 13706 : 14462 :: .52:.55, of an inch, the ultimate deflection." The least consideration will show that after the elasticity of a beam is injured by the weight placed upon it, the deflection must increase in a greater ratio than the weight. The amount of the error introduced may be determined, not very nearly, but with sufficient accuracy to enable us to decide upon the method of calculation, by comparing some of the deflections under the later weights applied to the beams, with the deflections near the breaking point as given by experiment. In the subjoined table we have made such an examination. The first column gives the number of the experiment referred to; the second, the number of pounds which gave the observed deflection in the third; the fourth, the last weight under which the deflection was estimated; the fifth, the deflection under this weight; the sixth, the deflection calculated from the second, third, and fourth columns, supposing the deflections to be proportional to the weights; the seventh, the differences between the observed and calculated deflections; the eighth, the breaking weights to compare with the last weights (in column fourth,) under which the deflections were observed, and upon which the ultimate deflections are calculated.

No. of exp't	Weight in lbs.	Deflection observed.	Last weight for which deflection was observed.	Observed deflection.	Calculated deflection.	Difference.	Breaking weight in lbs.
11	11186	.40	13706	.52	.49	.03	14462
12	16226	.49	16730	.53	.48	.05	16730
15	15393	.33	16401	.53	.33	.20	16905
18	14345	.33	18265	.43	.42	.01	19441
20	18265	.36	22969	.50	.45	.05	23249
21	16697	.42	20617	.54	.52	.02	21009
23	10017	.80	12815	1.08	1.02	.06	13543
24	10017	.53	12087	.63	.63	.00	15129
25	12087	.45	15129	.58	.56	.02	15129
26	15913	.40	21401	.65	.54	.09	22185

It is unnecessary for our purpose to extend this table further. Two of the experiments contained in it, viz. 12 and 25, give the observed ultimate deflections for the breaking weights: the differences in all the cases are by no means so great as to require any other mode of deducing the ultimate deflection to be resorted to.

The conclusions which are deduced from comparing the ultimate deflections of beams having nearly the same ratio of top and bottom rib, are not based upon an amount of experiment which *commands* our assent. To conclusion that the "deflections are as the depths; for the products of the depths and deflections were equal in the two experiments, since $4.1 \times 1.14 = 6.93 \times .67$ very nearly," is derived, directly, from only two experiments, viz. 23 and 26. It, however, is supported by other experiments less directly to the point, and has been shown for the material generally by other experimenters.

The next conclusion contradicts the generally received law of deflection while the elasticity remains perfect, and goes to establish that the ultimate deflections are more nearly as the lengths than as the squares of the lengths. We give the author's reasonings upon this subject.

"2nd. For the ultimate deflection in terms of the length. The mean deflection of the beams in experiments 15, 18 and 20, (in which the span was four feet six inches, and depth five and one-eighth inches,) was .51 inch; and in experiment 24 (where the span was seven feet, and the depth 5.2 inches, nearly same as the others,) the deflection was .79 inch. Hence the ultimate deflection in these was simply as the length; for 4 feet 6 inches : 7 feet : : .51 : .79 inch.

Supposing the ultimate deflections to be inversely as the depth when the length is the same, if we reduce the deflections in experiments 23 and 26, to what they would have been if the depth had been five and one-eighth inches, the deflections from both these would have been .91; for $\frac{1.14 \times 4.1}{5\frac{1}{8}} = .91$ and $\frac{6.93 \times .67}{5\frac{1}{8}} = .91$. The

lengths of the beams here being seven feet, as in experiment 24, the deflections are about one-seventh higher than .71, the quantity which we have just found they should have been, if the deflections had been as the lengths. Comparing likewise the length and deflection in experiment 28 or 31 with those in experiment 32, where the depth was the same, we find that double the length gave there more than three times the deflection.

"From these different experiments we find that the ultimate deflections are in a higher ratio than as the lengths, but are not as the square of the lengths, as is generally assumed.

"3d. The ultimate deflections, we see, are in a ratio somewhat higher than as the lengths; and comparing those in experiments 30 and 33, with that in experiment 32, they appear sometimes to increase faster than the depths decrease. If, however, the ultimate deflections were directly as the length and inversely as the depth, or were higher than in both of these ratios in an equal degree, we should conclude that a beam of double the length and depth of a given one would ultimately be deflected the same quantity as it. To see how this accords with the experiments, we will take the short beams, in experiments 28 and 31, and compare their deflections with those from the beams of double their length and depth in experiments 30 and 33; the ultimate deflections from the small beams were .56 and .59 inch respectively, and those from the large ones were .64 and .63 inch. Whence it appears, that the deflections were nearly, but not precisely, equal; there being, in both cases, a deflection somewhat greater in the larger beam."

Further experiments seem to be wanting to establish this point.

B.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JANUARY, 1832.

With Remarks and Exemplifications, by the Editor.

1. For a *Cement for Wood, Brick, Stone, and Iron Work;* Richard Walsh, Boston, Massachusetts, January 5.

This cement is to be made by mixing together one quart of ground lime, two of calcined plaster, and three of Roman cement. To these are to be added two pounds of black lead, one quarter of a pound of red lead, and the same quantities of copperas and of litharge.

These ingredients are to be incorporated in boiled linseed oil and spirits of turpentine, in the proportions of one part of the former to two of the latter; and it is said that when brought to a proper consistence for spreading, this preparation will afford a slate coloured cement, calculated to defend the material upon which it is laid from the action of the weather. The colour may be varied by mixing with the other materials any suitable colouring ingredient.

When we read the title of this patent, we expected to meet with a cement for uniting substances together, and not with a mere paint for spreading over surfaces in the ordinary way. As a paint, the

composition is rather heterogeneous; some of the substances named may be left out without any disadvantage, or others may be added without abstracting from the good qualities of the mixture. The patent, however, is taken for the precise compound, and such as it is, those who use it, must purchase a right, or invade the claims of the patentee.

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2. For an improvement in the *Mill Stone for grinding grain;* David Stem, Mechanicsville, Vanderburgh county, Indiana, January 5.

This grist mill is to act upon the well known principle of many paint mills. The runner is to be a cylinder, revolving horizontally, and the bed stone a hollow segment in which it fits, the stones being furrowed in a suitable manner. The bed stone is to be borne up against the cylinder laterally, and the feeding regulated by their greater or less distance apart. There is no claim made, nor is there much room for one.

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3. For an improvement in the *Fanning Mill;* Samuel Fitch, Otsego county, New York, January 6.

The *improvement* here offered consists in putting an eccentric wheel upon each end of the shaft of the revolving fan, which wheels act upon levers, giving motion to the shoe, "which motion is necessary to the cleaning of grain." No more.

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4. For an improved machine for *Breaking and Dressing Hemp and Flax;* Ebenezer C. Chase, Jay, Oxford county, Maine, January 6.

A cylinder four feet in diameter, and two feet long, is to be fluted from end to end, all round, so as to form it into teeth. A block of wood is to be placed above this: this block is to be a cube of two feet on each side, excepting that the bottom is to be hollowed to suit the cylinder, and it is also to be fluted in such a way that its projecting angles, or teeth, may fit into the spaces between those on the roller. The cylinder is to be made to revolve, and to act upon lifters which raise the block, in order to its falling upon the hemp or flax which is to pass between it and the roller. There is a feeding apron upon which the flax or hemp is to be laid, and a delivering apron to conduct it off after it has been operated upon. There is no claim made.

This machine very much resembles the ordinary Dutch brake in its mode of operation, although it differs much from it in form; we do not perceive how it is calculated to do the work better, or with greater facility than many other machines which have been made.

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5. For an improvement in the *Tin Bake Oven;* William Lewis, Franklin, Delaware county, New York, January 6.

The top and bottom parts of this tin oven are to be formed into regular flutes from front to back, in order to reflect the more heat upon

the substance to be cooked; there is also to be a reflecting piece along the front. The sides are to flare out a little, like a Rumford's fire place; the dripping pan is to rest upon three wires crossing the oven, and upon each of its ends there is to be a handle; the whole, so made, constitutes the patent oven.

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6. For an improved *Machine for Cutting Books;* Archibald O. Douglass, city of Philadelphia, January 6.

This cutting press is intended to accomplish the same purpose with that described at page 234 of the last volume; that is, the book is to be supported upon a platform which is capable of being raised or lowered at pleasure, to suit the length and width of the volume; the means of adjusting, as well as many other things in this press, differs however, from that alluded to, as well as from the common cutting press. The patentee calls this a box press, which name it receives from there being side and end pieces strongly framed together, and consisting of thick plank like that used for the cheeks in other cutting presses. Through one of these sides, work the wooden screws which force up a sliding cheek to hold the books; and round the heads of the screws a strap passes which is to operate as a band to cause one of them to turn by turning the other. Whatever may be the general good properties of the press, we are confident that this band will not accomplish the object for which it is intended; this, however, is a point of little importance. The manner of fixing the plough, and of adjusting the various parts, we cannot attempt to describe without a drawing.

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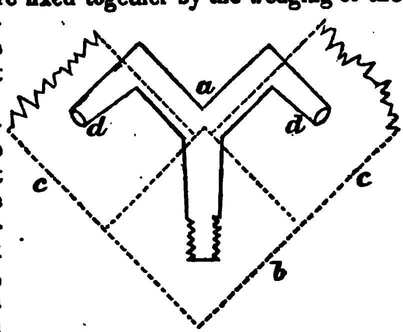
7. For an improvement in *Bedsteads;* Cornelius Vannoy, Lexington, Fayette county, Kentucky, January 10.

Two improvements are here proposed; one of them, in the mode of fastening the rails to the posts, the other in the mode of tightening the sacking bottom. One of the methods proposed for fastening the rails, is similar to such as have been long in use, consisting of a piece on the end of the rail, which passes into an opening on the post, so that by turning the rail they are fixed together by the wedging of the pieces. There is another method stated, which appears to be new. A cast iron hold-fast is to be made in the form of *p*, which is to have its shank fastened into the post *b*. The two hooks, which stand nearly at right angles with each other, are to fit into holes bored in the insides of the rails *c c*. The hook parts *d d* stand a little wedging, and when the rails are driven on to them, their ends, which are worked off square and smooth, are drawn up against the post.



Although this plan is new, we do not think it superior to others previously in use; indeed, we believe that a well made bedstead, with good screws, fitting indiscriminately, is to be preferred to most of the patented fastenings.

The modes of cording the sacking bottoms do not offer any thing particularly worthy of attention, not being better than former plans.

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8. For a mode of *Restoring sour, stale, or musty Ale, Beer, or Porter*, to their original flavour and purity, by the operation of re-brewing; Moses Granger, Louisville, Louis county, New York, January 11.

A mash is to be prepared in the usual way, and the wort drawn off from it. To the malt grains which remain, the sour ale, or beer, is to be added, say to the amount of sixty gallons to forty bushels of grains, and drawn off. This liquor is to be boiled with hops, in the proportion of half a pound to a barrel, after which it is to be put into a clean vessel, and kept for mashing at a subsequent brewing, which, we are told, will restore the liquor to its former state of sweetness and purity.

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9. For an improvement in *Locks;* James Meneely, Watervleit, Albany county, New York, January 12.

All that is claimed by the present patentee is the making the box of the lock, and all the necessary upright pieces within it, of cast iron; the staple or catch, with the necessary screw holes, are also to be cast, as are the bolt, the screw, the key holes, and the wards. For the doing of this, an exclusive privilege is demanded; the claim to *novelty* and *invention*, rests insecurely on such a basis, or we are mistaken in our views of the patent law.

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10. For an *Ice Steam-boat*, for clearing harbours, &c. of ice; Robert Irvine, city of Baltimore, January 12.

Many trials have been made with differently constructed ice breakers, to be worked by steam, but it has been found more difficult to accomplish the object practically, in a harbour or river, than had been anticipated in the parlour. In the plan now proposed we do not see any thing likely to remove the difficulties.

When ice has acquired a considerable thickness, to break and get it out of the way of the boat and paddle wheels, is a very slow process; and to construct and keep a machine in readiness for this purpose alone, requires more remuneration than the few occasions for its employment would be likely to afford.

In the plan before us there is to be a gang of saws in front of the boat, thirteen saws being represented in the drawing. Shanks rise from the upper ends of these saws, by which they are attached to a vibrating frame, as from the nature of the work which they have to perform they must be made sufficiently stiff not to require straining below. The shanks, we are told, should be of round iron, eight feet

long, and six inches thick; the saws three feet six inches long, and an inch and a quarter thick, on their front edges.

An ice breaker, consisting of a plate of iron two inches thick, and extending the whole width of the gang of saws, is placed behind them, and the whole are to be made to vibrate by a crank shaft, acted upon by the steam engine. The saws are to make 100 strokes per minute.

Until this machine is put into operation, and has established its character by success, we deem it needless to say any thing further respecting it, excepting to promise that when this period arrives, we will repair forthwith to the scene of action and report the facts.

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11. For an improvement in *Manufacturing Hats;* Joel Taylor and Charles Brown, Danbury, Fairfield county, Connecticut, January 13.

Rabbit's, or other similar fur and cotton, are to be mixed together, in equal, or other, proportions, and bowed in the usual manner of bowing fur. The bats, or flakes, are then to be wrought by rolling and planking in the usual manner; the dying, stiffening, napping, or covering, are also to be effected in the ordinary way.

The claim is to the mixing of cotton and fur, in the manufacture of hat bodies.

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12. For a machine for *Dressing Mill, and other Stones;* John Keeper, Williamsport, Lycoming county, Pennsylvania, January 13.

A chisel, or cutter, for dressing the stone is fixed on to the end of a handle, which is to be raised by machinery. There is a frame which stands horizontally, and the handle, carrying the chisel, is attached to a shaft crossing this frame at about its middle, and working on gudgeons within it. A cylinder, with cams, or wipers on it, is turned by a crank, the cams acting upon the far end of the handle, lifts it like a tilt hammer, and a steel spring bearing upon the handle near the chisel, or cutter, increases its force in descending. The frame is fixed upon a sliding carriage, allowing it to move backward, forward, or laterally; and a regulating bar across the frame is made adjustable by screws, to determine the depth of the furrows.

When the stone is to be dressed it is secured in a proper position, and the machine adjusted to it. The crank handle is then to be turned, and the proper sliding motion given to the frame. The claims are to "the regulating screws, the regulating bar, and the slides."

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13. For an improvement in the *Plough;* Thomas A. Whities, Bellfontaine, Logan county, Ohio, January 14.

The principal part of the specification of this plough is occupied with the admeasurement of its respective parts; and we are told that "it is composed of wood and wrought or cast iron, and steel." The manner of bracing and putting it together are particularly described; the inventor "believes that it will run much lighter than any now in use, turning over an equally large, if not a larger, furrow, and it may

be used in the foulest land without choaking." To what part it is indebted for those properties which are its recommendation we are not informed, as there is no claim made, or any thing else to indicate the points of novelty.

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14. For a *Machine for bending Felloes for carriage wheels;* Tristram Kimball, Salem, Rockingham county, New Hampshire, January 16.

Pieces for felloes are to be split out, and reduced to a proper size for bending, which is to be effected by the machine. A long ground sill is laid upon cross pieces, and to one end of this a lever is attached by a joint. Upon the sill, near the joint, a shaping block is to be placed; this consists of a piece of wood, the upper side of which is a curve adapted to the inside of the felloe to be formed, and above it, on the under side of the lever, is a follower, concave below, to force the felloe on to the shaping block. The lever is of considerable length, and may be loaded at its extreme end, so that its weight shall suffice to bend the felloe. On the ends of the shaping blocks there are ears, with mortices through them to receive pins, or bolts, which are to confine the felloe upon it after it is bent, allowing one shaping block to be removed, and another substituted in its place as the felloes are bent. A windlass with a rope and pulley, is attached to the lever, for the purpose of raising it. There are various props, braces, &c. which are figured and described, but which we need not notice.

The claim is to "the before described machine for bending felloes for carriage wheels."

The patentee says that the wheels made of felloes so bent, besides being cheaper, are stronger and better than any wheel heretofore constructed. Allowing this to be the case, the patent has nothing to do with wheels thus made, but merely with the machine for bending the felloes; and this may be done as readily by other methods, not interfering at all with "the before described machine."

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15. For an improvement in the *Throstle Frame* for spinning cotton: Seth Simmons, Providence, Rhode Island, January 16.

We have not been able to obtain a clear idea of the details of this throstle frame, although its general structure is sufficiently apparent. There is a drawing, in perspective, very well executed as a picture, but defective in consequence of its not showing distinctly those parts upon which the merits of the invention depend.

We are are told in the specification that the improvement consists in taking the thread from the roller in the centre of the balance flyer, running it thence through the gudgeon and pulley, and then through two holes in the balance flyer, &c. &c. The spindles, instead of being placed vertically, form an angle of forty-five degrees with the horizon; they are denominated independent spindles, being so constructed as to move round either slowly or rapidly in filling the bobbin. This, if we understand the specification, is to be effected by springs of wood, which, by means of thumb screws, may be made to bear

with greater or less force against each spindle. The principle claimed as original is "the method of bearing against the spindle."

If we have communicated a clear idea of this invention, the merit will belong exclusively to the reader, as our own conceptions of it are altogether confused.

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16. For an improved *Surveying Compass;* William J. Young, city of Philadelphia, January 17.

The improvements in the compass, or circumferenter, here patented, are two. The first consists in making the compass plate double, the plates of which it consists turning round upon each other. The circle of the compass is divided in the usual manner; the lower plate is also divided into degrees and parts of degrees, which are hidden excepting at one point, where an opening through the edge of the upper plate exposes them. In this opening there is a vernier, graduated so as to divide the divisions on the lower plate into any required part of a degree. The lower plate is capable of being rendered stationary by means of a screw; and when this is done, angles may be laid off by means of the sights, which may be moved round with the upper plate, without employing the needle for that purpose; thereby avoiding the uncertainty, or the difficulty, attending the process.

The second improvement consists in colouring the surface of the compass plate green, or bronzing it, instead of silvering it in the usual way, thereby relieving the eye from the unpleasant and injurious effects of the white plate. A narrow silvered rim surrounds the bronzed surface, giving a distinct view of the needle point.

Those who are aware of the excellence of the instruments made by Mr. Young, will be prepared to believe that what he denominates improvements are really such, and the result in the present instance will certainly justify the anticipation.

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17. For a *Universal Mill,* for grinding paints, drugs, dye stuffs, corn, rye, wheat, barley, oats, and various other substances; James Bogardus, city of New York, January 18.

In this mill, both the stones are made to revolve, but the upper one receives its motion from that of the lower, in a way to be presently described.

The lower stone is fixed firmly upon a vertical shaft which is made to revolve by the application of any suitable power, and with any required speed. The upper stone is made smaller than the lower, say one-fifth less in diameter, and it is placed so as not to be concentric with it; it may, for example, be so situated that the peripheries of the two stones will coincide on one side, whilst on the opposite side one-fifth of the diameter of the lower stone will be exposed.

The upper stone is kept in its place and its pressure regulated by means of a screw passing through a beam above it, the point of which bears upon a bridge piece in the middle of the eye. It will be at once evident that the revolution of the lower stone will give a slower and peculiar revolution to the upper. A hopper is to rise above the eye of the upper stone, and other requisite appendages are employed.

The claim is to "the manner of placing the upper stone off the centre of the shaft of the lower stone."

Metal, it is mentioned, may, in some cases, be employed instead of the stones for grinding.

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18. For *Sliding Valves for Steam Engines;* Thomas Halloway, Northern Liberties, Philadelphia county, Pennsylvania, January 18.

Side pipes are cast on the cylinder as usual, but so arranged as to adapt them to the particular construction of the slide valves. At each end of the cylinder, over the side pipes, a flat plate is cast, which has three openings in it, arranged lengthwise of the cylinder. They are equi-distant from each other, and the space between them is to be a little greater than the width of the opening. The faces of these plates must be ground perfectly true. The sliding valves which cover them are cast in one piece, being connected together by a stem extending from one to the other. There is an excavation on each of the sliding faces, which embraces two of the openings, and the space between these, forming a steam way from one to the other. Of the three openings at each end of the cylinder, the middle one communicates with the boiler, the inner one with the cylinder, and the one nearest the ends are for escape steam. The excavation in the valve as it slides, covers alternately the centre and inner, and the centre and outer openings. Those acquainted with the action of the engine will at once understand the operation of this valve.

It will be seen that this, like most of the patents taken for steam engines, is a mere point of modification or arrangement; it is, however, more simple than some of the slide valves in use.

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19. For a *Valve for the Vibratory Steam Engine;* Thomas Halloway, Northern Liberties, Philadelphia county, Pennsylvania, January 18.

(See specification.)

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20. For a *Wing Gudgeon Valve for Steam Engines;* Thomas Halloway, Northern Liberties, Philadelphia county, Pennsylvania, January 18.

(See specification.)

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21. For a *Machine for cleansing Paper Pulp,* called the "Piston Pulp Strainer;" James Sawyer, Newbury, Orange county, Vermont, January 21.

This pulp strainer differs entirely in its mode of action from that patented by Thomas L. Woodcock, p. 301, vol. vi. The pulp is put into a mixing tub, within which an agitator is kept in motion; attached to the mixing tub, is another, which the patentee calls the cellar, and between the two there is a part partitioned off, having a piston working up and down in it, which operates as a forcing pump. This piston is to make about fifty strokes in a minute; as it is raised

it admits a portion of the pulp from the mixing tub into the chamber, and as it is depressed, it forces this pulp into the lower part of the second tub, or cellar. Near the upper part of the cellar there is a metallic strainer covering its whole surface, through which the pulp is forced, and from which it runs through a spout into the vat. For an ordinary cylinder machine this strainer may contain about two and a half square feet of surface.

The chamber and piston are so constructed that the latter in raising, during about one-fourth of the stroke, tends to exhaust the cellar, and this draws a portion of the pulp back through the strainer, serving thus to free it from the knots and coarse stuff which would otherwise obstruct it.

The claim is "to the principle of cleaning paper stuff, or pulp, in the way and manner above described; that is, the application of a vacuum formed within or under the sieve or strainer, thereby causing a reaction of water back through the apertures of the sieve or strainer, about one-fourth part of the time, which serves to admit the stuff, or pulp, to flow freely through."

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22. For an improvement in *Cards for Carding Machines;* Edward Faber, Pittsburgh, Allegheny county, Pennsylvania, January 24.

A thin piece of sheet lead, or other metal, is to be laid on one or both sides of the card leather, which is then to be pritched for setting the teeth. The metal, or other material used, may be attached to the leather by glue, cement, or otherwise.

The object of doing this is to render the teeth more stable than when set into leather alone.

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23. For a combined *Clover, Corn Shelling, and Thrashing Machine, with a Grist Mill;* Daniel Mullier, Wooster, Wayne county, Ohio, January 24.

Each of these machines has its separate architypes in the patent office, and elsewhere. The clover machine is a cylinder rubbing against a concave bed; the shelling and the thrashing machines are also cylinders with suitable beaters and teeth, with corresponding concaves; the grist mill consists of iron disks, one foot in diameter, placed vertically, and the whole are fixed on one frame, and driven by bands and whirls. The claim made is to the combination of the several machines named.

With regard to the separate machines, we apprehend that they are all of sufficient age to have entered into public life, and their fathers are probably long since dead. What exclusive right the mere placing them upon the same frame can give to the patentee, we cannot perceive; to us it appears something like a patent for putting each of them into the same barn. New machines, it is true, are generally but new combinations of parts, or instruments, before known: levers, wheels, pinions, axles, cams, weights, and springs, have been long known and used; but they are still capable of new combinations, producing new machines, with new results; and it is this kind of

combination of old things which constitutes the subject matter of a patent. Should I make a machine like that described, but leave out the least valuable part of it, the grist mill, would the patentee still claim it as his combination? we trow not, as this would include the claiming of all the individual machines of which his combined machine is composed.

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24. For a *Machine for making Wrought Nails;* James W. Harvey, Jamestown, Chautauqua county, New York, January 24.

The nail rods are to be heated and passed down perpendicularly through a tube, or guide, between two swedging wheels, or rollers, which have indentations on them to form the edges and heads of the nails, and furnished also with chisels which cut them off of proper lengths. These rollers are made of steel, are ten inches in diameter, and of such thickness as the size of the nail may render necessary. On their lower sides they dip into boxes containing water, to preserve them from being too highly heated. The sides of the nails are to be formed by two other iron rollers, or wheels, which revolve at right angles with the swedging rollers. These are to be four feet in diameter, and are to approach each other sufficiently near to determine the thickness of the nail. All these rollers revolve in a vertical position. We shall not now attempt to describe the accessory apparatus for giving motion to the respective parts, as we deem this unnecessary. The claim is to the large rollers or wheels, for forming the sides of the nails; the swedging rollers, or die plates, not being considered as new.

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25. For an improvement in the mode of *Manufacturing Buck Shot;* John Snyder, city of New York, January 26.

A mould is to be made very similar to those heretofore employed for casting buck shot, or bullets in rows. In the one described, two rows are to be cast at once, there being three bars of brass hinged together at one end. The hemispherical excavations for receiving the lead are made close to the upper edge of the mould, so that the shot may be cast without any neck to it, the opening forming the apex of the shot, as it stands when cast. On the sides, and at one end of the mould, ledges rise to prevent the running off of the lead in casting. The mould being closed it is to be held with its handle end a little elevated, the lead poured on, and allowed to run down towards the hinged end, filling the cavities in its passage: before the metal has set, the lead is to be scraped off the top of the mould with a chisel, leaving the shot separate, and ready to be delivered from it. It is to this last feature that the claim is confined.

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26. For an improvement in the *Self-sharpening Plough;* Bancroft Woodcock, Mount Pleasant, Westmoreland county, Pennsylvania, January 26.

(See specification.)

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27. For a composition of matter to be used in the *Manufac-*

ture of Spruce Beer; George Jones, Boston, Massachusetts, January 27.

From the twigs, boughs, and leaves, of the double white spruce, a material is to be extracted, without boiling or distillation, which the patentee calls "the superior improved oil of spruce, for the making of spruce beer." To form it, two pounds of the leaves, &c. are to be bruised, and soaked for three or four days in alcohol, *of a very high proof.* To every gallon of this, when filtered, three pounds of the essential oil of spruce are to be added: this is the composition for which the patent is taken.

The superiority of this composition over all others, its various uses and great virtues, are enumerated and insisted upon with considerable amplification. To make beer, one ounce of the composition, and one gallon of molasses are to be well mixed together, and two gallons of boiling water are then added; a half barrel is to be used to contain the mixture, and is to be filled up with cold water, when its contents are allowed to ferment.

The process of soaking the boughs, twigs, and leaves in alcohol, and then mixing the infusion with oil of spruce, are the things claimed.

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28. For an improvement in the *Grist Mill;* Gideon Hutchkin, Windsor, Broome county, New York, January 27.

The object aimed at by the patentee, he informs us, is to grind rapidly with small stones without heating the flour; and consequently to lessen the expense of erecting, and the power required for driving such a mill.

A quadrangular frame is to be made in the usual way; on the lower end of the spindle there is to be a projecting rim, or flanch, just above its step, or point; a clutch box, catching above this projection, prevents the spindle from rising. The upper stone is to be the runner, which rests, by means of a balance rine, upon the upper end of the spindle; this being formed hemispherical, and the rine hollowed to suit it. Above the balance rine is a collet and nut, which secure the stone from rising.

The balance rine and driver are to be so formed as to blow wind into the eye of the stone, by their revolution, and channels, or tubes, are to be made to cause currents of air to pass between the stones. By loading the bridge tree, the stone may be forced down, or the top of the spindle may be weighted for the same purpose.

The claims are to increasing the gravity of the runner in either of the ways above named; the inserting wings, or flights; the form given to the driver and balance rine, and the pipes, or channels, for passing currents of air, &c. &c.

The particular forms of some of the parts described in the specification, are no doubt new; in other points, however, the present patentee has trenched upon preoccupied ground. The flanch, or button, at the lower end of the spindle, was particularly described in a patent noticed by us sometime since. Stones also have been loaded

at top, both by direct weights and by levers; and air holes have been made for the purpose of cooling the floor. The claim, therefore, if good, must rest upon the precise manner adopted by the patentee.

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29. For a *Machine for Washing Hats;* Samuel Drinkhouse, Easton, Northampton county, Pennsylvania, January 30.

A wheel six feet in diameter is to be hung by its axle over a trough containing water. Upon each side of the rim of the wheel there are to be pins upon which to place hats, and catches to secure them. A dozen may be placed on each side of such a wheel, and on turning a crank they will be rapidly washed. The whole machine is considered as new, no claim being made.

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30. For a *Piston Safety Valve* for steam engine boilers; John C. Douglass, city of New York, January 30.

The contrivance here proposed is to raise the ordinary safety valve when the steam arrives at a certain pressure, although, from expansion, or any other cause, it may adhere to its seat. The lever of the safety valve is to extend out beyond its prop, or support, on the side opposite to the arm carrying the weight valve, converting it, in this case, into a lever of the first kind: if the extreme end be depressed, the valve, therefore, will be raised. Near this end of the lever, a small cylinder, with a piston working in it, is inserted into the top of the boiler. The piston rod is held down with the required force by a spring steelyard, or by any other measured weight. From the top of the piston rod, a rope, or chain, descends, passes under a pulley, and up to the end of the lever, to which it is attached. When the force of the steam suffices to raise the piston, the end of the lever is, consequently, drawn down, and the opposite end, carrying the safety valve, is raised.

It is much to be doubted whether such an apparatus would generally accomplish the end proposed. The force by which the piston is held down must in but a small degree, exceed that at which the safety valve ought to rise, as it must act as soon as the valve itself ought to operate. When a valve adheres, as it sometimes does, with very great force, the extra elasticity which will enable the patented apparatus to overcome this adhesion, is replete with danger to the boiler, upon the whole interior of which its power is operating. It is to be borne in mind also, that although explosions do no doubt sometimes take place from the adhesion of the safety valve, this is not the only, nor indeed the most frequent, cause. Admitting, therefore, that the apparatus in question would always answer the purpose of its construction, it still must not be depended upon as affording any thing like perfect security. There is another circumstance which will militate against this apparatus, and which is inherent in the use of a steam-tight piston. The amount of friction to which it is subjected in its cylinder is perpetually varying, and the force necessary to raise it will consequently differ at different times; upon

the whole, therefore, we are led to the conclusion that this contrivance will not effect the object for which it was made.

31. For an improvement in the *Truss for Vessels;* Jonathan T. Quimby, Belfast, Waldo county, Maine, January 30.

So far as we are judges of nautical affairs, this truss appears to present advantages over those of the common construction. We cannot describe it without a cut, but the claim will show the nature of the improvements which the inventor believes that he has made. The hoop which encircles the mast is connected to the yard hoop by means of what is called a truss-bow, attached to wings or ears on the former. The yard hoop swivels on this bow by means of a socket joint. The claim is to the truss-bow, which is so constructed that it will not, in any position of the yard, interfere with the launching, sending up, or housing, of the top-mast. "The connexion of the hinge and swivel joints, which, as constructed, brings the centre of motion within two inches of the yard, so that when the yard is braced sharp to the wind it is not carried to the leeward any more than a distance equal to half its diameter, and consequently may be much more easily and quickly squared."

32. For a *Machine for Thrashing Rice and other Grain;* Orlando Hurd, Bridgeport, Fairfield county, Connecticut, January 31.

The cylinder and concave of this thrashing machine are to be covered with plates of cast iron, having spurs, or teeth, cast on them, to operate in the usual way. In its form and construction it is like the greater number of its elder brethren, some of which also have had teeth of cast iron. The patentee does not make claim to any thing new in it.

33. For an improved *Method of Generating power by High Steam;* Benjamin Phillips, city of Philadelphia, January 31.

Should it appear that the patentee of this improvement has really accomplished what he professes, his steam engine will be invaluable, as he informs us that he has invented a "method of generating power by high steam with perfect safety, and without danger of human or animal life, and without risk or possibility of explosion either of the boiler or generators." This he proposes to accomplish by a new and original plan of applying the fire; a new plan of constructing furnaces and generators, and other points of novelty.

The specification does not very distinctly explain the particular construction of some parts of the apparatus, nor do the references to the drawings supply the deficiency. There are in fact several figures in the drawings to which no reference whatever is made, and, although not entirely ignorant upon the subject of steam engines, we are not able to divine their use; these, therefore, we must pass over.

The cylinder is to have the usual shape, and the ordinary slide valves; and the improvement of this part consists in using strong cast,

or wrought iron heads, "with spherical surfaces inwards;" meaning, we suppose, that they are to be convex inwards. Coal furnaces are to be used to heat these heads *red hot*, which furnaces may be removed at pleasure. This, we think, is a bad beginning where perfect safety is a main object. There are to be vessels, which the patentee calls *generators*, but which are rather a species of steam chest, as they do not generate steam, but receive it from a boiler. They are to be of the same size with the cylinder, in order that they may contain steam enough to fill it. There must be two of them to supply steam on each side of the piston alternately. The boiler is to be of the low pressure kind, the steam is to pass from it into the generators, which are also to be heated by a coal furnace. It appears, therefore, that low steam is to be generated in the boiler; and that from this it is to pass into the generators, which being highly heated by their appropriate furnaces, are to convert it into high steam; from the generators it is to pass into the *red hot headed* cylinder, where it gets higher still, and is to act upon the piston with great force, and then to escape.

What the piston is to be packed with, and whether its rod is to pass through the red hot heads, we cannot tell, as neither the description nor the drawings enlighten us upon this point.

Another, or, we suppose, a modification of the same engine, is next noticed, but our picture of it would be less distinct than that just given, we therefore decline even to sketch it.

The machine already described, contravenes all our notions respecting the nature of steam, and the correct mode of applying it. This perhaps arises from an obtunded understanding, as the patentee avers that he has "described the foregoing inventions, improvements and discoveries in a true and correct manner, and in as clear a manner, and in as few words as possible to include all the sense and meaning, exact construction, and operation of the machine."

We think unfavourably of heads convex inwards, made red hot, to bear the pressure of high steam; we think unfavourably of the attempt to convert common into high steam, by heated generators, and heated cylinder heads, where no water is present to give the steam greater density; and we think unfavourably of the perfect security of generators which have, or which require, safety valves; because we believe that wherever safety valves are used, the idea of danger is admitted, and that where they are needed, danger does really exist. In fine, the whole of this contrivance appears to us under an aspect so unfavourable, that we should occupy too much space by arraigning its parts individually, whilst we should afford but little satisfaction to any one; we therefore leave it to the test of time and experience, wishing, though not hoping, that all the fond anticipations of its projector may be realized.

Specifications of American Patents.

Specification of a patent for a Valve for the Vibratory Steam Engine. Granted to Thomas Halloway, *Northern Liberties, Philadelphia county, January* 18, 1832.

To all whom it may concern, be it known, that I, Thomas Halloway, have invented an improvement in the construction and arrangement of the valves of the vibratory steam engine, and that the following is a full and exact description of my said invention.

I intend, usually, to place the trunnions or gudgeons upon which the cylinder is to vibrate, at or near its centre; this, however, is not a point of importance, as my principle is equally applicable in all situations of the trunnions, or gudgeons. In one of the trunnions, or gudgeons, there are two openings made for the admission of steam into each end of the cylinder. In the box, pedestal, or bearing, of this gudgeon there are three openings, one of which is in the centre for the escape of steam, the other two are for the admission of steam into each end of the cylinder, respectively. These openings are so arranged that when the engine is at half stroke, they are all closed; and at or near the end of the stroke, one of the openings in the gudgeon is over one of those for the admission of steam, and the other over that for the discharge of steam. This arrangement will be distinctly seen by the aid of the drawings, and the references thereto, deposited in the patent office, and making a part of this specification.

To prevent the raising of the cylinder from its bearing by the pressure of the steam, and to keep the gudgeon in proper contact with the pedestal, I apply a spring on the upper part thereof, or cause a friction roller to press thereon, or make use of any other device which I may prefer.

Among other advantages of this arrangement is the dispensing altogether with packing, the facility of oiling, and the certainty of the valve always remaining steam tight.

What I claim as my invention is the manner and principle of arranging the valves, or the openings for the admission and the discharge of steam, as hereinbefore described.

Thomas Halloway.

A patent was granted to Elisha Bigelow, of Baltimore, on the 6th of November, 1826, for a similar mode of letting the steam on and off in the trunnions of a vibrating engine, and there are others in which the same method is adopted, varying slightly in the mode, but acting essentially on the same principle.

Specification of a patent for a Wing Gudgeon Valve for Steam Engines. Granted to Thomas Halloway, *Northern Liberties, Philadelphia county, Pennsylvania, January* 18, 1832.

To all whom it may concern, be it known, that I, Thomas Halloway have invented an improvement in the valves of steam engines, which I intend to apply to locomotive operation only, and which is called the "Wing Gudgeon Valve," and that the following is a full and exact description thereof. I intend that the cylinder, or cylinders, to which my valves are applied, shall vibrate, in general, vertically, but this is not a point of importance, its position being governed by circumstances.

The cylinder is to have one large gudgeon, close to which, above and below, is a face plate, or wing, with an opening leading to each end of the cylinder, longitudinally, which face is exactly in the shape of the segment of a circle, as is shown by a model and drawings, deposited in the patent office.

The piece constituting the valve seats is cast about the width of the boiler, with a plate on each side corresponding with the face on the cylinder, and may be circular, or straight, according to the form of the top of the boiler. This valve seat has two distinct openings leading from a double division cock in the centre to the valve seats which the cylinder vibrates against, and passes out in two openings on each side, corresponding to the openings on the plate of the cylinder; and with the vibration of the cylinder it alternately receives and discharges steam.

It will be understood by every competent engineer that both the face of the plate valve seat, and that of the plate on the cylinder, are to be turned perfectly true, and made steam tight, and will be kept up by a spring, friction roller, or weight.

The cock, which has been mentioned, in the centre of this valve seat, and on the centre of the boilers, is to be so constructed that by turning half round, it reverses the power of the engine; that is, it makes the steam side the exhaust side, and vice versa; and it also answers to shut the steam from both engines: [qu. ends.]

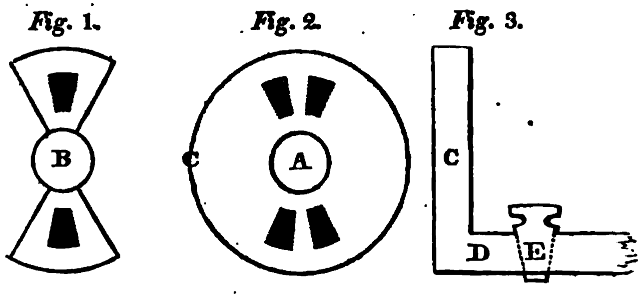
What I claim as my invention is the arrangement of the cylinders and valves to a locomotive engine; the mode of fitting the valves; the construction of the cock in the centre to determine the direction of the engine forward or backward; and the simplicity of the whole, not having half the number of pieces when completed that the generality of English engines have.

Thomas Halloway.

Fig. 1, is the face of that half of the valve which is cast on the cylinder, with openings leading through the steam ways to the two ends of the cylinder.

Fig. 2. A circular plate forming the other half of the valve, faced to fit steam-tight on fig. 1. A, is an opening in it, to receive the trunnion or gudgeon B, fig. 1.

Fig. 3. A side view of fig. 2. C, the edge of the plate. D, a double tube connected with the boiler; the cock E changing either of the tubes into a supply or discharge tube.



Specification of a patent for an improvement in the Self-sharpening Plough. Granted to Bancroft Woodcock, *Mount Pleasant, Westmoreland county, Pennsylvania, January* 26, 1832.

To all whom it may concern, be it known, that I, Bancroft Woodcock, have invented certain improvements in the self-sharpening plough, and that the following is a full and exact description thereof.

In the self-sharpening plough, as heretofore made, the front part of the land side is cast in one piece with the mould board, and as the bottom edge of the land side wears, the part forming the groove into which the coulter slides gives way, and cannot be renewed without renewing the whole casting.

To obviate this objection, I cast the land side separately from the mould board, either in one or two pieces, as may be preferred. When made in two pieces they have a lap joint at or near the middle, which may be secured by a bolt and nut. Suitable holes to receive bolts and nuts, to attach the land side and mould board together, are also provided.

In forming the pattern for the mould board, I make its top to terminate in a standard, or sheath, extending up to the beam, and attach it thereto by a bolt and nut, or otherwise, and in forming the pattern of the land side, the front end of it is made with an arm or piece extending up so as to form a coulter.

For ploughing in rough or stony land I dispense with the coulter as ordinarily made, and substitute therefor what I call a pointed shank, passing it into the groove, and securing it in the same way with the coulter. When I use this, an erect coulter stands in front of it, the upper end of which is secured to the beam in any of the known ways. A hole or depression is made in the heel of the erect coulter, and into this the point of the shank passes, which serves to support and keep it steady. The respective parts herein named will be better understood by reference to the drawing deposited in the patent office.

What I claim as my specific improvement, and for which I ask a patent, is, first, the casting of the land side separately from the mould board, either in one or two pieces, as hereinbefore set forth; and I likewise claim the shank as described, to be used in lieu of the ordinary coulter, with its point entering the heel of the erect coulter in the manner and for the purposes specified.

BANCROFT WOODCOCK.

ENGLISH PATENTS.

Specification of a patent granted to ANGIER MARCH PERKINS, *county of Middlesex, Civil Engineer, for certain improvements in the apparatus or method of heating the air in buildings, heating and evaporating fluids, and heating metals. Dated July* 30, 1831.

To all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Angier March Perkins, do hereby declare the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the following description thereof, reference being had to the drawings hereunto annexed, and to the figures and letters marked thereon, (that is to say:)

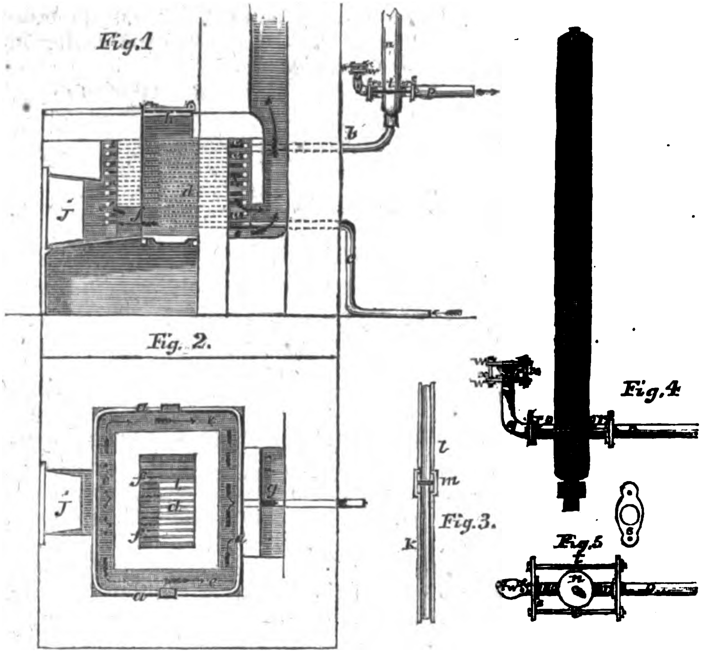
My invention relates to that description of apparatus or method of heating which is now largely employed in heating buildings, and for other purposes, by the circulation of hot water; and the object of my improvements thereon is to obtain considerably higher degrees of temperature to the water circulated, and thus I am enabled to apply my apparatus to a variety of purposes which require the heating medium to be at a higher degree of temperature than that of boiling water. And my improvement consists in circulating water in tubes or pipes which are closed in all parts, allowing a sufficient space for the expansion of the water which is contained within the apparatus, by which means the water will at all times be kept in contact with the metal, however high the degree of heat such apparatus may be submitted to, and yet at the same time there will be no danger of bursting the apparatus, in consequence of the water having sufficient space to expand.

But in order that my invention may be fully understood and carried into effect, I will now describe the drawings hereunto annexed, which represent the improvements applied in various ways.

Description of the Drawing.

Fig. 1 shows the section of the description of furnace I prefer; and fig. 2 is a plan also in section: in each of these figures the same letters of reference indicate similar parts, and such is the case in the other figures in the drawings. The description of tubes which I have used and find to answer, are what are called drawn gas tubing; and the size I most commonly employ is about one inch out-

side diameter, and the diameter of the inner area is about five-eighths of an inch; but I do not confine myself to the use of this size tubing.



In figs. 1 and 2, *a a a* is a coil of tubing, which is placed within the furnace, as shown in the drawing; *b* is a tube by which the water passes from the coil *a*, when in a heated state, and *c* is the tube by which the water is returned to the coil after having given off the heat, to effect the object to which the apparatus is applied, whether for heating the air in buildings, evaporating fluids, or heating metal, as will be more fully described hereafter.

The furnace consists of two compartments *d* and *e*; the compartment *d* is that in which the fuel is burned, and the compartment *e* surrounds that at *d*, and is a sort of hot chamber, into which the coil of tubes *a* is placed, and the water therein becomes heated by the heat which is generated in the compartment *d*, the smoke and heated air passing from the ignited fuel at *f*, into the compartment *e*, and thence into the chimney *g*.

The description of fuel which I prefer is coke, or stone or other coal, as free from bituminous matter as possible, which is put into the compartment *d*, at the upper part at *h*, over which there is placed at all times a cover, to prevent any draft passing in that direction, by which means, when the fire is lighted, and the fuel is filled up to the top of the compartment *d*, and the opening at *h* covered, the air which produces the combustion will pass up through the fire bars at *i*, and

the fuel on such bars will in a short time become an ignited mass: *j* is an opening or door in the front of the furnace, by which the same may be stoked, or the fire lighted.

Figs. 3, 4, and 5, show the manner in which I construct the joints of the apparatus, which are shown on a larger scale for the purpose of making them more clear. Fig. 3 shows in section the manner of connecting two tubes, *k* and *l*; it will be seen that the end of the tube *k* is tapered off both inside and out to a sharp edge, which buts against the straight surface of the end of the tube *l*. On the ends of these tubes are cut screws, the one having a right hand screw, the other a left hand screw, and by means of the coupling piece *m*, which has a female screw cut right and left, the two ends of the tubes *k* and *l* are brought together, and by this means a strong water-tight joint is made, and in this manner I connect any number of tubes together, according to the purpose to which the apparatus is to be applied.

Figs. 4 and 5 are two views of the connexions of other parts of the apparatus, and also of the part of the apparatus which is intended for the expansion of the water; *n* is an upright tube, closed at the top, having a small screw hole to let out the air when the apparatus is filled with water, but which is kept perfectly closed when the air is driven out. This tube *n* is usually made of a larger size than those in which the circulation takes place, and in this tube there should be an area equal to the quantity of expansion which will take place in the water contained in the outer tubes, and as water expands about one-twentieth without being converted into steam, I leave at least double that quantity of capacity in the tube or vessel *n*. *o o* are two short tubes formed into cones at their two ends: these cones enter into holes perforated in the tube *n*, and into the ends of the tubes *p* and *q*, the tube *p* being the one by which the hot water is conveyed from the coil *a a*, after it has become heated, and the tube or pipe *q* is the point at which the apparatus is filled with water, and by which the height of the water is regulated; and this tube *q* is to be placed in such a position that there shall be sufficient space above it in the tube *n*, to allow for expansion.

On the tubes *p* and *q* are two collars *r* formed, and by means of the two plates *s s*, and the screw bolts and nuts *t t*, there will be a strong water-tight joint formed to all the parts. At the top *v* of the pipe, there is a collar *r* formed, and by the plates *w*, and screws and nuts *x*, the cone *y* is strongly held in the opening of the tube *q*, by which the same is made water-tight when the apparatus has been filled with water. To the bottom of the expansion tube *n* is connected the pipe *b*, by similar coupling as that described in fig. 3.

Having now described the manner in which I conceive it best to construct the various parts of the apparatus, I will now proceed to describe some applications of the same. Fig. 6 shows a longitudinal view, and fig. 7 shows a plan of an arrangement for applying my improvements to hot plates which are intended to be used by copper-plate and other printers, for the purpose of heating the plates from which impressions are to be taken. I have not thought it necessary to show the presses, or any other parts of the machinery used for

printing. The plates A A being intended to be used in place of the charcoal fire grates heretofore employed for heating the plates at the time the ink is being rubbed in. One of these heated plates, A, is placed in the proper position at each press, if more than one is to be heated, and it will be evident that a large number of presses may have their plates A, heated by one set of tubes. The tube p is the one which, as above described, conveys the heated water from the furnace, and the tube c returns it back to the coil after it has given off its heat.

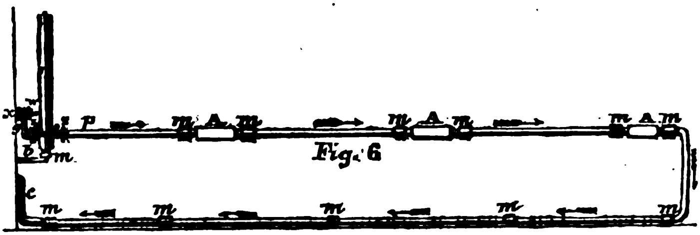


Fig. 6

Fig. 7

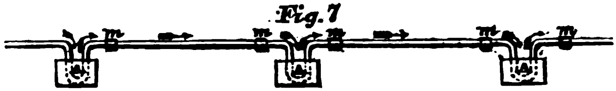
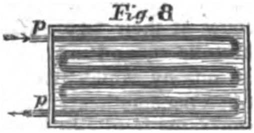


Fig. 8



The manner in which I construct the plates A, is as follows: I make a rectangular mould of the size required, and place therein the bent part of the tube p, and then fill the mould with melted lead, or other metal, according to the degrees of heat such plates are intended to bear, by which means I produce metal surfaces, which become heated by the passage of the heated water through the tubes p; and it is evident that such heated plates may be applied in a variety of ways, and for a variety of purposes, such for instance as hot plates for cooking purposes.

Fig. 8 shows the manner of applying the apparatus to a rectangular boiler, and which boiler is shown in plan, and is applicable to the boiling of sirop in the making or refining of sugar; by which it will be seen that the heated water is made to circulate through a series of tubes, and give off its heat to the fluid contained in the boiler, or these tubes may be made to pass into steam, or other boilers, in a similar manner, and will cause the fluid contained in such boilers to become heated and evaporated.

In heating the air of rooms of buildings, the tubes p and c may be made to pass around the flooring of such room, and where a large

quantity of heat is desired, it will sometimes be desirable to have more than one pipe passing to and from the coil of pipes contained in the furnace, whereby a larger quantity of heated surface will be presented, which being heated to a high degree of temperature, will give off the same to the air contained in the room or buildings, and warm the same; and I have found that when the circulating tubes present a surface equal to three times that of the coil of tubes in the furnace, I have not been able to burst the tubes.

Having now described the nature of my invention, and the manner of carrying the same into effect, I would have it understood that I lay no claim to the various parts of which such apparatus is composed. Neither do I claim the application of the circulation of hot water to the purposes above described; but what I claim as my improvements in such apparatus or method of heating the air in buildings, heating and evaporating fluids, and heating metal, consist in circulating water in tubes or pipes, which are closed in all parts, and having sufficient space allowed for the expansion of the water as above described.

In witness whereof, &c. [*Rep. Pat. Inv.*

¶ *Experiments on the Strength of different kinds of Wood, made in the Carriage Department, Royal Arsenal, Woolwich. By Peter Barlow, Jr. As. Inst. Eng.*

The following series of experiments, several of which I attended, being made on species of woods the strength of which has not been previously ascertained, will, I trust, not be considered uninteresting to the readers of the Philosophical Magazine and Annals, particularly as the results are not only curious, but may probably lead to useful and important investigations as connected with the introduction into, and the growth of foreign timber in, this country, as well as to important improvements in the present system of planting. Under this impression I have been induced to send them to you as an addition to the several others on the same subject which have appeared at different times in this Journal. The experiments originated in an investigation of the comparative properties of acacia and oak by W. Withers, Esq. of Norfolk, whose object appears to have been to encourage the planting of the former in many situations instead of the latter, as a wood of great durability, and of quicker growth.

In order to have a comparison made of their relative strength he forwarded specimens of both woods to Woolwich, and the results of the experiments will be seen in the following table. Another question arose with Mr. Withers relative to the strength of oak, the growth of which had been encouraged by culture, compared with oak of the ordinary slow growth.* The specimens connected with the latter subject, the author informs us, were received from Mr. W.

* See a letter to Sir Henry Stewart, Bart. on the improvement in the quality of timber, by W. Withers, Esq.

Boorne, of Erpingham, the one from a fast, and the other from a slow, growing tree. They are marked Nos. 3 and 4 in the table of experiments. The former was grown on a very good strong soil, its age was supposed to be about sixty years, and it contained from thirty-eight to forty cubic feet of timber: the other, No. 4, was about 120 years old, and was grown upon light soil, with gravel about two feet below the surface. This tree contained about eighty cubic feet, but Mr. Boorne considers that if No. 3 had stood to attain the same age, it would have made at least forty feet more than that tree. The other two specimens were from trees furnished by Mr. Samuel Farrow, of Diss, Norfolk, grown on the same piece of land: that from which No. 5 was cut stood near the rack yard of the farm by the side of a ditch, into which ran a great deal of moisture from the yard; and he has no doubt that, independently of the nourishment obtained by it from the ditch, very many of the smaller roots reached as far as the rack-yard: the tree grew rapidly, and contained when cut down 120 feet of timber. The tree from which No. 6 was cut, grew, as before stated, in the same field, but had none of the advantages above spoken of, but still the soil was good with a lightish blue clay bottom. The tree grew well, but not in any degree so fast as the other; it contained about ninety feet of timber, and it is the opinion of persons on the spot that they were both planted together.

Thus far the experiments were made with a particular object; but as there were in store in the Royal Arsenal, many woods not in very common use, but which are grown abundantly in some countries, and from the appearance of which great strength was anticipated, Mr. Bossey, foreman in the carriage department, was requested to prepare specimens, which were submitted to the same test as the former ones.

These results are interesting, some of the woods being more than double the average strength of oak: several of these specimens were sent from Berbice, by Capt. Gipps, of the royal engineers, who speaks very highly of their durability.

The apparatus made use of in the experiments consisted simply of two upright posts, fixed securely at one end in the ground, and at the other to the tie beam of the roof of a shed; on each of these were firmly attached two pieces of hard wood formed to an edge, on which the specimens to be experimented upon were placed, and a scale suspended from the centre to receive weights. To ascertain the relative stiffness or elasticity, the weight which caused a deflection of one inch, was registered. The deflection was denoted by a rod attached to the tie beam, so as to point downwards in front of the middle of the specimen, and one inch below the upper surface; so that when one inch of deflection had taken place, it was shown by the rod just passing clear of the piece under experiment.

In the table, the first column contains the names of the woods; the second the specific gravity; the third the weight which caused one inch deflection, or one-fiftieth part of the length; the fourth the breaking weight; the fifth the relative elasticity from the formula $E = \frac{l^3 w}{a d^3 \delta}$; the sixth the strength from the formula $S = \frac{l w}{4 a d^2}$; where l is

the length, a the breadth, d the depth, δ the deflection in inches, and w the weight in pounds, by which they become comparable with the various experiments in Barlow's Essay on the strength of timber; and the last column contains any requisite description or remarks.

The pieces were each accurately cut and planed two inches square and five feet in length, and the distance of the props on which they were broken was exactly fifty inches; they were selected with great care by Mr. Bossey, who assisted at the experiments, and registered and delivered the following results.

Table of the Strength and Elasticity of various Woods, of English and Foreign Growth.

No. of Expert.	Names of Wood.		Specific gravity.	Wt. in lbs. which produced 1 inch deflection.	Breaking weight in lbs.	Value of E from the formula $E = \frac{l^3 w}{4ad^3\delta}$	Value of S from the formula $S = \frac{lw}{4ad^2}$	Remarks.
1	Acacia, Eng. growth.		710		1195		1867	
2	——,	Do.	710	bore	1084	rope broke	the piece	little injured.
3	Oak, fast grown.		903	660	999	5156250	1561	Specimens
4	——, slow grown.		856	414	677	3234375	1058	supplied by
5	——, fast grown.		972	550	999	4296875	1561	W. Withers,
6	——, slow grown.		835	439	943	3437500	1473	Esq.
7	——, superior quality.		748	896	1447	7000000	2261	Fine specimen.
8	——,	Do.	756	680	1304	5312500	2037	In store 16 yrs.
9	Tonquin	middle.	1036	1388	2414	10843750	3850	
10	Bean	outside.	1080	1332	2228	10406250	3481	
11	Locust	middle.	972	1052	2116	8007812	3303	This timber
12		outside.	936	940	2284	7343750	3568	was sent
13	Bullet tree	middle.	1029	1360	1724	10625000	2696	from Berbice
14		outside.	1029	1332	1668	10406250	2606	by Captain
15	Green heart	middle.	1015	1332	1892	10406250	2956	Gipps, R. E.
16		outside.	986	1388	1612	10843750	2562	
17	Cabacally	middle.	907	952	1668	7437500	2606	
18		outside.	892	940	1556	7343750	2431	
19	African oak	middle.	972	1168	1447	9132812	2261	From a very
20		outside.	972	1168	1643	9125000	2589	fine timber
21		middle.	1015	1288	1643	10062500	2567	long in
22		outside.	972	1097	1643	8570312	2567	store.
23	American	middle.	648	775	1279	6054687	1967	A long time
24	black birch	outside.	633	775	915	6054687	1430	in store, very
25		middle.	648	644	1027	5031250	1604	dry; the
26		outside.	669	831	1433	6492187	2239	same tree.
27	Common	middle.	792	800	1164	6250000	1820	
28	birch.	outside.	630	884	1304	6908250	2037	
29	Ash	middle.	727	660	1304	5156250	2037	Dry, and of
30		outside.	702	660	1304	5156250	2037	same plank.
31	Elm	middle.	554	436	772	3406250	1206	Dry, and of
32		outside.	532	324	660	2531250	1031	same tree.
33	Christiana	middle.	698	856	1052	6687500	1644	Dry, and of
34	deal.	outside.	680	772	940	6031250	1480	same deal.
35	Memel deal	middle.	590	786	1108	6140625	1731	Dry, and of
36		outside.	590	856	1108	6687500	1731	same deal.

It is to be regretted that the results of the acacia were not more particularly noticed; but not having in view at that time to carry on so extensive a course of experiments, means were not taken to ascertain its stiffness. The second specimen, after the rope broke, was found but little injured by the experiment, which certainly indicates considerable power of elasticity, although the exact amount was not numerically ascertained. This specimen was preserved unbroken. Upon the whole, however, it has the advantage of the oaks in strength, except those marked No. 7 and 8, which were remarkably fine specimens; but it will be found by referring to Barlow's Essay greatly to exceed the strength of the oak in general.

The results of the oak experiments seem certainly to be in favour of the fast grown. "These experiments," Mr. Withers observes, "throw new light upon the subject, and lead to the most important conclusions. They prove not only that fast growing timber is superior in quality to that of slower growth, but by the constant application of manure to the roots of trees, planted even in good soil, nearly double the quantity of timber may be obtained in the same period, while its strength, instead of being diminished, will be thereby increased."

[*Phil. Mag. and Annals of Philos.*, *No.* 63, *March*, 1832.

¶ *Observations on Mr. Barlow's experiments on the Strength of different kinds of Wood. By B. Bevan, Esq.*

To the Editors of the Philosophical Magazine and Annals.

Gentlemen,—I have perused the valuable communication of Mr. Barlow, in your last number, on the strength and elasticity of several species of wood, and join in regret with Mr. Barlow that the experiments on acacia were not complete.

Some time since an opinion was held by some carpenters in Northamptonshire in favour of the superior strength and durability of acacia, and a prime specimen was sent to me for trial. I found it inferior to good oak in strength, and something inferior in elasticity; but as to durability, I am not aware of any proper test; but from the texture and appearance on fracture I should esteem it very inferior.

From my experiments on that species of wood, I can supply the omission in the fourth column of Mr. Barlow's table. The modulus of elasticity of acacia, by my experiments, being 4,560,000 feet, from which it will be easy to deduce the deflection of any scantling under a given pressure, and for the particular case of Mr. Barlow, where $l = 50\ b = d = 2$, and $\delta = 1$, and specific gravity .710, we have $\frac{.710 \times 4,560,000}{4,500} = 720$ nearly for the weight required to produce a deflection of one inch.

It will be observed by persons accustomed to experiments of this nature, that the deflection of one inch approaches too near the ulti-

mate flexure to give a fair measure of the elastic force of the specimen; the average of Mr. Barlow's experiments being nearly two-thirds of the ultimate strain, instead of one-third, which would have been less likely to have impaired the texture of the specimen.

In experiments of this nature it would have been more satisfactory if Mr. Barlow had said something about the *time* during which the specimen was under pressure; as the deflection increases with the time, especially when the load bears so great a proportion to the breaking weight.

Instead of the proportional numbers adopted by Mr. Barlow to express the elasticity, I beg leave to suggest that it would have been more generally useful if the *modulus of elasticity*, had been given. To enable your readers to compare the relative stiffness of the several species of wood in his experiments, I hereby send you the approximate result as deduced by a very simple application of the slide-rule. Thus,

a	4500	Feet modulus of elasticity.
b	specific gravity.	Weight in lbs.

From which it will be found that the mean modulus of the several species of wood in the table of Mr. Barlow will be nearly as follows:

	Feet.		Feet.
Oak	3.303000	American birch	5.295000
Tonquin bean	5.795000	Common birch	5.420000
Locust	4.695000	Ash	4.150000
Bullet	5.890000	Elm	3.135000
Green heart	6.105000	Christiana deal	5.305000
Cabacally	4.730000	Memel deal	6.260000
African oak,	5.532000		

Hence it appears that when compared with their own weight, (although probably the specimens were superior to the ordinary quality,) none of those tried by Mr. Barlow possess a greater degree of stiffness than Memel deal.

It would have added much to the value of the above experiments if Mr. Barlow had given the ultimate deflection. If he has the means of giving this information, it will add to the gratification of many of your readers, and to none more than to your humble servant,

B. Bevan.

P. S. If the price per foot at which the new species of wood above named can be procured, could be communicated, it would be an additional favour.

[*Phil. Mag. and Annals of Philos.*, *April* 1832.

Experiments with the Diving-Bell.—By Thomas Steel, Esq. M. A. Magdalen College, Cambridge.

In 1826 we gave an account of a communicating diving-bell, invented by our esteemed friend and correspondent, Mr. Steele. It consists, as some of our readers may recollect, of two compartments in combination; one of them, the common diving-bell, open at the bottom, the other a close chamber, with a bottom, called by the inventor, "the communicating chamber." The latter is supplied with air by pipes reaching above water, and is separated from the former by a partition, in which is set a small circular window of great thickness and strength, but so transparent as to admit of a person in one chamber seeing distinctly through into the other. Mr. Steele has recently projected some important improvements in this apparatus, a full description of which, from his own pen, we hope in a week or two to be able to lay before the public. With the view in the meanwhile, of preparing the reader to appreciate duly the value of these improvements, we now propose to give, in a somewhat abridged form, an account of the diving-bell experiments which have given Mr. Steele a practical knowledge of those difficulties which it has been his study to obviate, and which, if we are not greatly mistaken, he has obviated successfully. We extract it from the Appendix to Mr. Steele's "Practical Suggestions on the General Improvement of the navigation of the Shannon."

Narrative of circumstances which led to the invention of the communicating Diving-Bell.

Some years ago, I saw, lying near the harbour at Portsmouth, the diving bell which had been made use of by the late Mr. Thompson, when he descended upon the Royal George, sunk at Spithead; he called it his bell of observation, and it was calculated for no other purpose, as it was a close vessel. It was about six and a half or seven feet high, and of a form very like a grape jar. There was a water-tight circular cover that screwed into the top, and there were five small circular eyes, (little windows of strong glass,) of about four inches in diameter, in the circumference of the part where it swelled; and across each of these there was a small bar on the outside, to prevent fracture by impinging while under water upon any hard substance. There were two flexible tubes inserted into the cover by water-tight screws, and through these the engineer, when he descended, was supplied with air, and also held conversation with the persons above water. My curiosity was excited, and I went to Gosport to find out the person, who I was informed had been in the habit of attending upon deck when the bell was under water, to receive orders from below, and have them carried into execution. He afforded me a great deal of very interesting information, and particularly gave me assurance of the distinctness with which the voice could be heard

from under water, and conversation carried on through the tube, which was called the trumpet; the second tube was called the air pipe. The man's name who gave me this information is Wood, and I believe he now works at a shipwright's at Fareham.

In the year 1825 I made, for the first time, as a matter of curiosity, a descent in a common working bell, of course open at the bottom. While I was under water, I was more occupied in making observations on what I saw than in deducing consequences; but after ascending, it suddenly occurred to me, that I could make a great improvement in diving-bells, by combining with the common working bell the bell of observation; for "suppose there was a little window in the bell in which I was down, what would there be to 'prevent Thompson from looking into it from his bell and telling what he saw?"

Let me, therefore, suppose the two bells to approximate until they coalesce, and have a common side and common window; the engineer in the bell of observation, sitting without pressure from condensed air, and quite at ease, no matter at what depth the bell may be working, will look into a little submarine illuminated chamber, (the bell in which I descended had been illuminated by a lantern;) will see every thing that is doing, and hold conversation with the persons above water.

Thinking one evening afterwards of the violent strain on the chain of suspension, and the consequent danger, when the bell emerging, ceases to have any support from the water, I set myself to work, to find out some method of getting the men out unwet, without the necessity of raising the bell itself out of the water.

A mode of doing this, theoretically possible, quickly suggested itself to me; but one which, in practice, would call to memory the story in Peregrine Pickle, of the gentleman who was remarkable for great mechanical inspiration, and had invented a beautiful machine for cutting cabbages; to the general use of which, however, there was a practical objection, by no means unimportant, namely, that it required the aid of a man and a horse to work it in the cabbage bed.

This theoretical non-impossibility, was as follows: Suppose the bell, (I mean the common working bell,) to be brought to rest upon a ledge, or little platform, projecting horizontally under water from the side of the ship; suppose a tube of a diameter of something less than a yard, bent at an angle, and one leg so much longer than the other, that while the extremity of the shorter leg was placed under, and in contact with the platform, the extremity of the longer one should be above water. Now, imagine the shorter leg to be not merely in contact with, but united to the platform. Let us now suppose a circular hole in the platform over the tube, with an air-tight cover; and let us suppose the longer leg to terminate above water, in an air-tight chamber, with an air-tight door. Now it is quite evident, that if the air chamber and the tube be filled by a condensing air pump, with air as highly condensed as the air in the bell while it rests upon the platform, the circular cover might be unscrewed, and that the workmen might first descend into the short leg, and

then ascend through the long one into the chamber above, and so walk out dry upon deck, without taking the bell out of the water.

This, however, as I have said, was mere theorizing. Still an improvement, possible and practically useful, was the result of this theoretical non-impossibility; for it immediately suggested to me an air-tight chamber on deck, with windows in it like the bell of observation, and connected by a flexible tube with the working bell; and so gave, as an immediate consequence, a second mode of 'communicating,' by conversation, with the persons below.

Experiments with the Communicating Diving Bell—Related by a friend of Mr. Steele's.

The inventor before descending, placed a lighted lantern in the open compartment; he next entered the communicating chamber, through a circular aperture, which was firmly screwed down upon him; and he then gave orders to be lowered under water.

In this descent, the water was prevented from entering the open bell by the ordinary operation of the condensing air-pump upon deck; and Mr. Steele had consequently an opportunity of observing every thing within it strongly illuminated by the lantern; while, at the same time, instead of being obliged to endure the pressure of condensed air, and to depend upon signals by strokes of a hammer, he sat at his ease in air of no greater density than that of the atmosphere, and conversed through one of the pipes with his friends above water.

While he remained down, he described what he saw in the open bell, and gave such directions as circumstances rendered necessary. During this time, by simply turning a cock, he had the means of refreshing the air in his chamber at pleasure, by a current of condensed air from the open bell. After some time, he desired that they should heave up, which was done; the water-tight cover was unscrewed, and he came out evidently very much gratified by the success of his first experiment.

He next took his seat in the open bell, and a bell-man took the place he had just ceased to occupy. The communication between persons descending in this manner, is by writing; they write upon tablets, and mutually exhibit them at the window in the partition. They descended; the bell-man described what he saw to the persons above, and after they had been under water for some time, when Mr. Steele chose to ascend, he intimated his desire to him, and he immediately communicated the order that the bell should be raised. After they came out of the bell, preparations were made for putting the *second* proposed mode of communication to the test.

An air-tight chamber above water, with a window like the one already described, was connected by a flexible pipe with the open diving bell; the bell-man took his seat in this, one of the engineer's workmen went into the communicating chamber, and Mr. Steele himself, taking his tablets and pencil, went into the chamber above water, into which he was immediately fastened by an air-tight cover.

The bell was lowered under water, and of course the chamber above was filled, through the pipe, with condensed air.

At this moment a novel and complex system of communicating by conversation and writing, was thrown into action, instead of signals by the strokes of a hammer. Mr. Steele, in the air chamber above, held conversation with the bell-man below, and the man in the communicating chamber below, conversed with the persons upon the deck of the vessel. A gentleman stood close to the chamber above, and he and Mr. Steele exhibited writings to each other through the window. The latter wrote, among other things, that he had just asked the man below if he was anxious to be heaved up, and that he had been answered in the negative. The men then made some observations about the noise in the bell, caused by the rush of the condensed air through the valve, and about some other circumstances bearing relation to the experiment. At this time, Mr. Steele required some paper, and a sheet tightly rolled was given in to him through a cylinder passing through the side of the chamber. This was furnished with two cocks, one on the inside, and the other on the outside; so that the paper was transmitted without the escape of the air. Soon after this, I observed that he exhibited at the glass, an order for heaving up, and the bell was raised. When he was liberated, and while he was receiving the congratulations of his friends, I heard him say to one of them, that his feeling was one of extreme delight, at the moment when, looking out from the little window of the air-chamber, after the full success of his experiments, he saw his diving bell emerging slowly from the water, and the persons who had descended come out from it in safety.

Note by Mr. Steele.

The men in the working bell under water, are much more comfortable than the person in the air chamber above, although the condensation of the air be in both cases equal, as the air chamber becomes very quickly heated and oppressive, and the window looking out upon deck becomes dimmed so rapidly, that it must be frequently cleared, by rubbing it with a handkerchief. I think (but am not at all sure, not having yet proved it by experiment,) that I see a practical way of preventing this.

There is an exceedingly interesting, but apparently paradoxical consequence, resulting from the theory upon which the air chamber has been constructed. 1st. Let the diameter of the pipe between this chamber and the bell be supposed to be increased until it be sufficient to admit a man, and let a rope ladder be inclosed in it. 2nd. Let the air chamber be subdivided into two, with a man-hole in the partition, and another in the side. It is evident that, by a process analogous to that of passing locks in a canal, and identically the same with that used by Mr. Steele himself, in the transmission of the roll of paper through the two air tight cocks, a man might go down unwet from deck, to blast rocks, or do any other work at the

bottom of the sea! The same thing might be effected by the addition of a third compartment to the bell below, between the communicating chamber and the open bell; in which case, the air chamber above water would (for this particular purpose,) cease to be necessary. It is manifest, however, that these two modes of passing and repassing between the deck and the bottom, might be used even in combination. [*Mech. Mag.*

¶ *Experiments on the Expansion and Contraction of Building Stones, by variations of Temperature; communicated by William H. C. Bartlett, Lieut. U. S. Engineers.*

Fort Adams, Newport Harbour, March 12, 1832.

TO PROFESSOR SILLIMAN.

Sir,—In the progress of this work, we have had occasion to use considerable quantities of coping stones, taken from different localities, with all of which it has been found impossible to obtain tight joints. The walls on which these stones were placed have not undergone the slightest change; and, notwithstanding they were laid with the greatest possible care, and their joints were filled with the best cements that could be devised, yet, at the expiration of a few weeks, these joints were broken up by fissures which extended from the top to the bottom of the coping. These fissures were supposed to have arisen from a change of dimensions in the coping stones, in consequence of the ordinary variations of atmospheric temperature; and, with the view to ascertain if the total amount of cracking could be attributed to this cause alone, a series of experiments was instituted by order of Col. Totten, and continued from August 18th, 1830, to June 2nd, 1831. The circumstances connected with these experiments, as well as their results, you will find subjoined. Col. Totten requests me to communicate them to you, supposing that you may find them of sufficient practical importance to deserve a place in your Journal.

These experiments were made, nearly at the same time, upon granite, limestone, and sandstone, the kinds of stone used for the coping; and for this purpose a piece of each was selected in such a manner that the three pieces were of nearly equal lengths. The granite has a fine grain, is of a compact texture, and was taken from a boulder at the head of Buzzard's bay: the limestone is white, has a fine grained crystalline structure, and accompanies primitive rocks; it was taken from the quarries of the Sing-sing State Prison, New York: the sandstone is from the quarries in Chatham, Conn., and belongs to the old red sandstone formation, according to the Rev. Edward Hitchcock;* it has a granular structure, rather coarse, and its cement is argillo-ferruginous.

* He *now* refers all the sandstone of the Connecticut valley to the new; see the first article in the present No.

To ascertain the exact lengths of these pieces at the different temperatures produced by exposure to the weather—these alone being important for our immediate object, and for the purposes of construction generally,—the measurements were made by means of a white pine rod, with copper elbows at the ends embracing the stones when applied to them, as represented in the sketch.

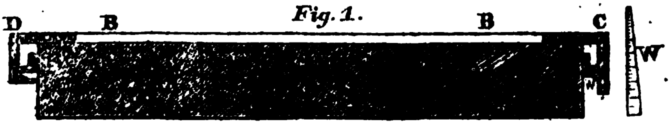


Fig. 1.

Fig. 2.

A A is an elevation, or vertical section lengthwise, of the stone to be measured; B B the measuring rod, with elbows, D and C, of thin hammered copper, firmly secured to it. The end D was always adjusted to the same part of the stone, by sliding through a groove in the copper guide F, cemented to the stone; the elbow C was adjusted in like manner by sliding through a groove in the piece E also attached to the stone. The elbow C has itself a groove through which the wedge W may slide horizontally, under the guide E, between the elbow C and the stone: this wedge, being graduated as a diagonal scale, showed, by the distance which it entered, the difference between the length of the measuring rod and that of the stone. The expansion of the measuring rod being known, the length of the stone could be calculated in decimals of a constant unit, viz. the English standard inch.

A groove was cut in the stone in which a thermometer was placed, at each measurement, and being covered, was suffered to lie some time, in order to ascertain the temperature of the stone. The temperature of the measuring rod was assumed to be that of the open air to which it had been exposed.

By Lardner and Kater's Mechanics, we have as a mean between the results of Capt. Kater and Dr. Struve for the linear expansion of deal wood in terms of its length for one degree of Fah. the decimal .00000255; and by the Edinburgh Encyclopædia, art. Expansion, we find the decimal .00000944 to express the same for hammered copper. From these data the actual length of the measuring rod was calculated for each experiment; knowing its length at sixty degrees Fah. But to abridge the calculation, the difference in length between the stone and measuring rod, as shown by the wedge W, was subtracted from the length of the rod before making the reduction for the temperature of the latter. The length of the copper part, and that of the wooden part, were calculated separately on account of their different expansibilities. The result of this calculation is the following table.

MARBLE.			GRANITE.		SANDSTONE.	
No. of Exper't.	Degrees Fah.	Length in inches.	Degrees Fah.	Length in inches.	Degrees Fah.	Length in inches.
1	6°	93.4155	6°	94.0251	6°	94.0180
2	7	93.4277	8	94.0330	8	94.0153
3	9	93.4201	9	94.0260	9	94.0052
4	10	93.4207	10	94.0265	10	94.0088
5	11	93.4131	11	94.0230	11	94.0124
6	12	93.4186	12	94.0282	13	94.0211
7	14	93.4174	14	94.0271	14	94.0206
8	14	93.4294	14	94.0347	14	94.0220
9	14	93.4308	14	94.0361	15	94.0235
10	16	93.4302	16	94.0285	15	94.0238
11	16	93.4291	16	94.0345	17	94.0214
12	17	93.4305	17	94.0358	18	94.0181
13	19	93.4327	19	94.0416	20	94.0239
14	20	93.4310	20	94.0364	22	94.0258
15	21	93.4316	21	94.0440	22	94.0263
16	31	93.4265	32	94.0324	32	94.0371
17	32	93.4352	32	94.0406	34	94.0466
18	34	93.4422	36	94.0330	38	94.0554
19	36	93.4360	36	94.0450	39	94.0436
20	36	93.4357	37	94.0483	39	94.0592
21	38	93.4436	41	94.0344	43	94.0486
22	52	93.4323	52	94.0348	53	94.0560
23	58	93.4450	62	94.0541	64	94.0718
24	83	93.4655	86	94.0720	93	94.0879
25	86	93.4649	88	94.0737	93	94.0829
26	90	93.4709	88	94.0688	95	94.0897
27	99	93.4677	89	94.0731	99	94.0941
28	.	. .	90	94.0693	100	94.0906
29	.	. .	91	94.0693	101	94.0944
30	.	. .	94	94.0628	104	94.0841
31	.	. .	102	94.0721	109	94.0792

It is probable that many of the discrepancies here noticed were owing to the hygrometric state of the stone; and perhaps, in part, to imperfections in the measuring apparatus; but as the hygrometric state of the stone was not recorded, we can take no account of it in our deductions. These discrepancies, however, will have but little effect upon the general result; for it will be observed, that there is always an increase in the length of stone for an increase of temperature, when any two experiments are considered which are removed from each other by several degrees.

From the facts ascertained concerning the expansion of other substances, we may assume that the expansion of stone is uniform, and that, within the range of our experiments, each of the stones increas-

ed in length by a common difference for each degree of the thermometer. To find an approximate value for this common difference, say for the granite, we subtract the first observed length from the last, and, if these experiments were accurate, the difference .0470, would be ninety-six times the common difference: ninety-six being the difference in degrees between the extreme temperatures: the same operation being performed with the second experiment, and that next the last; the difference .0298, (the difference in lengths,) should be eighty-six times the common difference. By thus comparing the extreme experiments of those which remain, we obtain the following table.

Experiments.	Diff. in degrees.	Diff. in lengths.
1 and 31	96	+.0470
2 and 30	86	+.0298
3 and 29	82	+.0433
4 and 28	80	+.0428
5 and 27	78	+.0501
6 and 26	76	+.0406
7 and 25	74	+.0466
8 and 24	72	+.0373
9 and 23	48	+.0180
10 and 22	36	+.0063
11 and 21	25	—.0001
12 and 20	20	+.0125
13 and 19	17	+.0034
14 and 18	16	—.0034
15 and 17	11	—.0034
Total,	817	.3708

We have neglected the sixteenth experiment, because we cannot employ it without using some other experiment twice, thus giving the latter an undue influence; and because the middle term should have the least weight in determining the common difference.

By the above table, we find, as the combined result of all the experiments, that .3708 should be eight hundred and seventeen times the common difference; and hence the common difference for one degree of Fah. is .0004538 inch. Now, assuming 94.05 inches, as the mean length of the granite, which is sufficiently near, we find the linear expansion for one inch of stone for each degree of Fah. to be $\frac{.0004538}{94.05} = .000004825$ inch, and for one foot this expansion would be .0000579 of an inch. By proceeding in the same way with the experiments on the other stones, we obtain the following results.

Mean whole length in inches.		Common difference in inches for the whole length of stone for one degree of Fah.	Common difference in inches for one inch for each degree of Fah.
Granite,	94.05	.0004538	.000004825
Marble,	93.44	.0005297	.000005668
Sandstone,	94.05	.0008965	.000009532
White pine,		- - -	.00000255
Hammered copper,		- - -	.00000944

To apply these results to the case in question, let us suppose two coping stones of five running feet each, to be laid in mid-summer, when they have a temperature of ninety-six degrees Fah.; in winter their temperature may safely be assumed at zero, so that the total variation of temperature will be ninety-six degrees; and if we suppose these stones to contract towards their centres, which would be the most favourable supposition as regards the tightness of the joints where a number of these stones are used, the whole length of stone put in motion by a change of temperature would be five feet. If the coping be of granite, the distance by which the ends of the stones would be separated, in consequence of *one* degree's variation, would be sixty inches multiplied into .000004825 = .0002895, and for a variation of ninety-six degrees, this distance becomes .0002895 × 96 = .027792 inch, giving a crack a little wider than the thickness of common pasteboard. For marble, this crack would have a width of .03264, nearly twice the thickness of common pasteboard; and for sandstone .054914, nearly three times the thickness of pasteboard. These cracks are not only distinctly visible, but they allow water to pass freely into the heart of the wall. The mischief does not stop here: by this constant motion back and forth in the coping, the cement, of whatever kind the joints might be made, would be crushed to powder, and in a short time be totally washed by the rains from its place, leaving the whole joint open.

[*Amer. Jour. of Sciences and Arts.*

¶ *First Report of the Proceedings of the British Association for the Advancement of Science, assembled at York.*

The appearance of this report has put the scientific public in possession of the authorized account of what has been done by this very important society, and of what may be expected from its exertions.

We cannot but consider that the British Association has started under auspices the most favourable, and even the results of the first meeting, and the prospects of support which this report displays, certainly exhibit a much greater step towards the fulfilment of a great series of objects requiring much time for their development than could possibly have been anticipated.

That the Association has already secured in its favour a great share of the best talent in the country, the list of members annexed to the report will best testify; it is in every respect a most creditable phalanx of names. Fortunately, however, it is not upon names alone, that its prospects of support must rest; the pamphlet before us contains pledges of exertion from some of the most active philosophers in the country, of a description which has been unattempted by any previously existing society among the many which this country possesses. There is no society, strictly scientific, which professes to direct the attention of its members, or of philosophers at large, to particular branches of knowledge, in which important progress might be made by a well directed system of mutual co-operation. Take, for example, the science of meteorology, in which observers have been so long at cross purposes, and in which the very same amount of exertion, which has been thrown away upon forming registers utterly useless for want of information or combined exertion, might have been rendered available to the highest purposes of science. To this subject the Association has properly directed peculiar attention; and, it may be hoped, with the happiest results.

But there is nothing which strikes us with more admiration amongst the energetic proceedings of this infant institution, than the list of reports on the state and progress of the different sciences. This is a species of literature quite new in this country, and which will form a body of information really invaluable. The only approximation to it has been in the annual addresses of the president of the Geological Society upon that particular branch of science. These admirable discourses have only excited the wish that something more general, upon the same plan, should be attempted. The objects of these scientific reports will, we believe, be more varied and extended; and it is probable, that, for the first year at least, the style of execution of them will much depend upon the views and opinions of the individuals by whom they are composed, until some formal plan shall have been sanctioned by usage for general adoption. Some account of the different labours of philosophers during a recent period of time, with a view of their bearing upon the past progress and future prospects of the sciences, will, we presume, be a general object of these reports; but we trust that in many of them more extended and philosophical generalizations will be taken; and in several sciences we do not know a more acceptable service that could be performed, than a correct estimate of the precise point to which our knowledge has arrived, and where precisely our ignorance begins. From this process some conclusion will naturally be drawn as to the line, or lines, which present the fairest points of attack upon the remaining strong holds of science.

The names of those who have engaged to execute these useful labours in science include some of the most active philosophers in Britain; and we anxiously hope that nothing will deter those who have given this capital portion of the machinery of the Association the weight and sanction of their names, from fulfilling, in as full a manner at least as leisure will permit, the agreement to which they are

in some measure pledged, and which will be valuable to science and to the Association, in proportion to the acknowledged eminence of their scientific character.

As we cannot but look upon this as one of the most important parts of the pamphlet before us, we shall insert the list of reports contained in the preface.

"1. The Rev. George Peacock has undertaken to present to the next meeting, a report on the recent progress of Mathematical Analysis, in reference particularly to the differential and integral calculus.

"2. Professor Airy has undertaken a report on the state and progress of Astronomical science, in reference particularly to Physical Astronomy.

"3. J. W. Lubbock, Esq. has consented to furnish such information respecting the data and desiderata for calculating the time and height of High-Water as he may be able to offer.

"4. James D. Forbes, Esq. has undertaken to present a report on the present state of Meteorological science.

"5. Dr. Brewster has undertaken a report on the progress of Optical science.

"6. The Rev. Robert Willis has undertaken a report on the state of our knowledge concerning the Phenomena of Sound, in reference especially to the additions recently made to it.

"7. The Rev. Professor Powell has undertaken a similar report respecting the Phenomena of Heat.

"8. The Rev. Professor Cumming has undertaken a report on Thermo-Electricity, and on the allied subjects in reference to the discoveries recently made in them.

"9. James F. W. Johnston, Esq. has undertaken a report on the recent progress of Chemical science, especially in foreign countries.

"10. The Rev. Professor Whewell has undertaken a report on the state and progress of Mineralogical science.

"11. Robert Stevenson, Esq. has undertaken the report recommended by the Geological and Geographical Committee, on the waste and extension of the land on the east coast of Britain, and on the question of the permanence of the relative level of the sea and land.

"12. Professor Lindley has undertaken to give an account of the principle questions recently settled, or still agitated, in the Philosophy of Botany."

No less than six of these twelve reports are to be contributed by eminent members of the University of Cambridge,—a circumstance certainly highly indicative of the warmth of feeling of that great body towards the objects of the British Association, as well as giving a pledge for the ability of the works thus undertaken. The former distinguished professor of mineralogy at Cambridge was among the earliest supporters of the plan, to which he alluded in a letter communicated to the York meeting, an extract from which is given in Mr. Vernon Harcourt's address. "A collection of reports," he

says, "concerning the present state of science, is on all accounts much wanted, in order that scientific students may know where to begin their labours, and in order that those who pursue one branch of science may know how to communicate with an inquirer in another. For want of this knowledge we perpetually find speculations published which show the greatest ignorance of what has been done and written on the subjects to which they refer, and which must give a very unfavourable impression of our acquirements to well-informed foreigners."—Report, p. 29.

The report is divided into three distinct portions, as the title page indicates. The first contains the proceedings of the meeting towards the constitution of the permanent body or association which sprung from it, and the subsequent arrangements necessary to its complete constitution. The second part embraces the proceedings of the general and the sub-committees appointed to carry into effect the objects of the Association, and which, it will be seen, were by no means limited to the week of the meeting at York. The third division contains the scientific transactions of the meeting at York, comprising the order and periods of the meetings, with abstracts of the papers presented. One communication, printed at full length, is the excellent essay of Dr. Henry, of Manchester, upon the philosophical character of Dr. Priestley.

It is not our intention to enter into any analysis of these several departments. But we feel it to be only due to the very able address of Mr. Vernon Harcourt, the real originator of the *permanent* association, to make one or two quotations from it; for we view it as an address differing much from what is too often found upon such occasions, as perfectly free from affectation, as abounding in the soundest views of the present state of science, and written in a manly and highly perspicuous style.

The following passage sets in a true light the bearing of the new association upon already existing societies:—"It is not by counting the great luminaries who may chance to shine in this year, or that,—in a decade of years, or a generation of men,—that we are to inform ourselves of the state of national science. Let us look rather to the numbers engaged effectually, though less conspicuously, in adding by degrees to our knowledge of nature; let us look to the increase of scientific transactions and journals; let us look, gentlemen, at the list produced this day of philosophical societies which have grown up in all parts of the kingdom. The multiplication of these new and numerous institutions indicates a wide extension of scientific pursuits. The funds so liberally contributed to their support bear evidence of an enlarged disposition in the public to promote such pursuits.

"It is on this very ground I rest the necessity and the practicability of establishing in science a new impulsive and directive force, that there are new and more abundant materials to be directed and impelled. The mining field of discovery seems to me to show, on the one part, the ore breaking out on every side; veins of the precious

metal scarcely opened or imperfectly wrought; and on the other a multitude of hands ready to work it, but no one engaging them to labour, or showing them in what manner they may employ their industry to the best advantage. And therefore it is that I propose to you to found an Association, including all the scientific strength of Great Britain, which shall employ a short period of every year in pointing out the lines of direction in which the researches of science should move, in indicating the particulars which most immediately demand investigation, in stating problems to be solved and data to be fixed, in assigning to every class of mind a definite task, and suggesting to its members, that there is here a shore of which the soundings should be more accurately taken, and there a line of coast along which a voyage of discovery should be made.

"I am not aware, gentlemen, that in executing such a plan we should intrude upon the province of any other institution. There is no society at present existing among us, which undertakes to lend any guidance to the individual efforts of its members, and there is none, perhaps, which can undertake it. Consider the difference, gentlemen, between the limited circle of any of our scientific councils, or even the annual meetings of our societies, and a meeting at which all the science of these kingdoms should be convened, which should be attended, as this first meeting you see already promises, by deputations from every other society, and in which foreign talent and character should be tempted to mingle with our own. With what a momentum would such an association urge on its purpose! what activity would it be capable of exciting! how powerfully would it attract and stimulate those minds, which either thirst for reputation or rejoice in the light and sunshine of truth!"

[TO BE CONTINUED.]

Notice of Electro-Magnetic Experiments.

[Communicated by Prof. A. D. BACHE, of the University of Pennsylvania.]

TO THE COMMITTEE ON PUBLICATIONS.

GENTLEMEN,—I send you a description of the apparatus for producing the spark from a magnet according to the method of Nobili, and for other recent and curious experiments on electro-magnetism; together with an account of their repetition. This is done that any one who may be desirous to repeat or to extend the experiments may, without delay, be put in possession of the means of so doing.

Extract of a letter from J. Saxton, of Philadelphia, to Isaiah Lukens, dated London, April 14th, 1832.

"You may have heard of Faraday's curious discovery in electro-magnetism. He has succeeded in obtaining from a magnet a spark

resembling the electric spark. The apparatus consisted of a copper plate mounted on an axis, like an electrical machine, and made to revolve between the poles of a large magnet. The plate used was about one foot in diameter, and one-eighth of an inch in thickness. The rim of the wheel was amalgamated, as well as a ring around the axis. Two pieces of copper, shaped to fit, for two or three inches, the amalgamated ring and the circle, were attached to either wire of a galvanometer. These pieces of copper being applied to the wheel, and the latter turned, the needle of the galvanometer vibrates: the amount of vibration may be increased by alternately touching and removing one of the plates. The copper plate which touches the rim should be between the poles of the magnet.

"I have made this experiment in a different way and succeeded satisfactorily. The method was as follows. A coil of wire wrapped with silk, similar to that used in the galvanometer, was attached by the ends to the wires of the galvanometer. On passing this roll backward and forward upon one of the poles of a horse-shoe magnet, or placing it upon and removing it from either pole, I have made the needle of the galvanometer spin round rapidly."

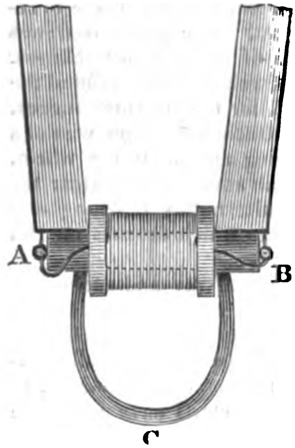
Extract of a second letter from J. Saxton, of Philadelphia, to Isaiah Lukens, dated London, May 11, 1832.

"Since my last I have heard of a method of producing a spark from a magnet, discovered, I believe, by an Italian. This experiment I made at once upon a large horse-shoe magnet which I am making for Mr. Perkins and his partners. One of your large magnets will answer the same purpose. Make a cylinder of soft iron of an inch, or three-fourths of an inch, in diameter, and of the usual length of the keeper; place two disks of brass or wood upon this cylinder, and at such a distance apart that they will conveniently pass between the poles of the magnet; between these wind, say fifty feet of, bobbin wire, which may be of iron covered with cotton; let the ends of this coil be bent over the ends of the cylinder and brought down until they touch the poles of the magnet, the ends should be of such a length that on bringing the cylinder to the magnet, one of the ends will touch when the cylinder is about half an inch from the magnet, and the other at one-fourth of an inch. The cylinder being thus arranged, and in contact with the magnet, on drawing it suddenly away a spark will pass between the end of the wire and the pole of the magnet."

The apparatus alluded to in these letters was, soon after their receipt, put together by Messrs. Isaiah Lukens and Benjamin Say; it is figured in the cuts which follow.

Fig. 1 represents the apparatus of Nobili for procuring the spark

Fig. 1.



A B C

from a magnet. A, B, is a cylinder of soft iron, upon this are two brass rims, between which bobbin wire (wrapped wire of iron and copper were both successfully used,) is wound; the ends of the wire coil are carried out at the opposite ends of the cylinder, and being bent downwards pass through holes in two brass (or wooden) pins. The spring of the wire causes both the ends to touch the magnet when the keeper is attached, when it is withdrawn one end projects beyond the other.*

This apparatus has been improved by Mr. Lukens by coiling the ends of the wire into a spiral, thus forming a spring to press the points of the wire against the poles of the magnet; and by carefully insulating the ends in their passage through the brass stems.

From this improved apparatus a spark can be obtained on *removing* the keeper with seldom a case of failure; frequently two sparks appear, one at each end of the wire, and in some experiments of Messrs. Lukens and Say a third spark was seen to pass from one of the brass rings. I have very frequently obtained sparks also by rapidly *replacing* the keeper.

To ascertain the nature of this spark, I endeavoured to determine whether the removal of the keeper which produces the spark was attended with any electrical effect which would warrant the supposition that this was an electric spark.

The cylindrical keeper, arranged as at first described, was used for this purpose. The ends of the wires spoken of as touching the poles of the magnet were bent outwards, to remove them from the poles, and connected with the wires of a galvanometer. On approaching the keeper to, or drawing it from, the magnet, an agitation of the needle of the galvanometer was produced, demonstrating the existence of a current of galvanic electricity, to which, therefore, the spark is probably due.

A few turns, say four or five, of iron bonnet wire about the keeper of a magnet, which supported, by a contact with its whole surface, fifty pounds, produced a very sensible vibration in the needle: the contact and removal being made at times tending to increase the arc.

In the experiments of MM. Nobili and Antinori, the account of which has been received since those which I have described were made, it seems that this development of a galvanic current which they observed led them first to suspect that the spark might be obtained.

The following observations were made at the same time with those above described, on the direction of the galvanic current. The needle of the galvanometer used, was suspended by a fibre of silk; upon the

* This condition appears by subsequent experiment to be by no means essential.

stand of the instrument were two brass cups in the same plane with the coils of the wire surrounding the needle; into the cup corresponding to the south pole of the needle, the wire passing from south to north *above* the needle, and from north to south below, was placed; into the north cup was inserted the opposite wire. Thus arranged, a current of galvanism passing from south to north will deflect the north pole of the needle to the west; by a current passing from north to south the north pole of the needle will be deflected to the east. The galvanometer was covered by a glass receiver to prevent agitation from currents of air. The magnet used was the one alluded to above as supporting fifty pounds, this is a horse-shoe magnet, made of ten magnetic bars, the keeper being filed off in front applied itself to two of these.

The magnet being placed with its poles to the south, (the north pole being westward) the keeper was brought to the magnet in such a position that the coil was directed *above* the cylinder from *north to south; below* from *south to north;* the wire from the *upper side* was dipped into the mercury of the *south* cup of the galvanometer; the wire from the *under* side into the *north* cup.

On drawing the keeper from the magnet, the north pole of the needle of the galvanometer passed to the west; the needle being allowed to return to the meridian, a return of the keeper to the magnet deflected the north pole to the east. By assisting the needle in its vibrations by the alternate withdrawal and return of the keeper, a very considerable vibration was produced.

By changing the keeper from right to left so that the wire passing *over* the cylinder was directed from *south to north,* the communications with the galvanometer remaining as before, the reverse of the deflections just described took place.

The effects described may be represented by a galvanic current circulating around the keeper, and at right angles to its axis, directed from north to south above the cylinder when the keeper was withdrawn, in the contrary direction when it was returned. Such a current would evidently have passed out of the upper wire on the withdrawal of the keeper, and out of the under wire on its return; that is, would have passed from south to north, above the needle of the galvanometer, in the first case, and from north to south in the second.

Fig. 2.

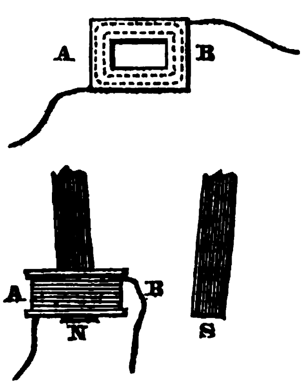


Fig. 2 shows the apparatus for producing vibration in the needle of the galvanometer by the wire coil and magnet. A, B, is a roll of wrapped wire wound about a wooden spool, which has the central part removed; the ends of the wire are connected with the wires of a galvanometer; this roll is represented in the lower part of the figure as placed upon the north pole of a horse-shoe magnet, by passing it to and fro

upon the leg of the magnet, or by alternately removing and replacing it upon the pole, a vibration is produced in the needle of the galvanometer. The wires are continued to such a length as to prevent the direct action of the magnet upon the needle of the galvanometer.

Some experiments which, by the kindness of Mr. Lukens, I was enabled to make with this apparatus, resulted in a satisfactory mode of representing the effect which is produced upon the galvanometer in any given position of the coil. I offer it simply as a mode of recollecting the results of observation.

The coil of wire (fig. 2,) was first applied to the north pole of the magnet, the direction of the coil being from right to left above the magnet, the inside wire of the coil was on the left hand, the outside wire on the right, the experimenter facing the north; the outside wire was carried to the south cup of the galvanic multiplier, the inside to the north cup. The poles of the magnet were turned to the south. On withdrawing the coil from the pole, the north pole of the needle was deflected to the west; returning the coil, carried the same pole to the east. Changing the wires of the coil in the cups of the galvanometer reversed the direction of the vibration of its needle.

The effect of withdrawing the coil would have been produced by a galvanic current passing through the coil from left to right below the magnet, from right to left above it.

The coil was next changed from right to left; that is, the direction of the coil changed so that it passed from right to left below the magnet, and from left to right above it; the wires which dipped into the cups of the multiplier remained in their places; the inner wire was now to the right hand, the outer wire to the left. On removing the coil from the north pole of the magnet, the north pole of the needle of the multiplier passed to the east, on returning the coil the same pole moved to the west.

This effect would (as before,) have been produced by a galvanic current passing from left to right below the magnet, from right to left above it. The other positions of the coil being examined showed that they might be represented by the same supposition of a circular current about the pole of the magnet, and passing through the wire. The reverse of such an hypothesis is of common application to represent the action of the conjunctive wire of a galvanic battery upon a magnetic needle.

The south pole of the magnet presented opposite results, the effects produced by removing the coil were such as would have occurred in replacing it upon the north pole.

As the removal of the coil produces a contrary effect from that obtained when it is placed upon the pole, the representation is complete from the opposite magnetic currents produced in these cases. When the coil is drawn along the magnet towards the north pole, it is easy to conceive that passing successively to more magnetic parts, or exposed to magnetism of different intensities, the current of magnetism, with regard to the wire, is from south to north; this, by the reversion of the hypothesis in relation to the galvanic current, produces (since the north pole is towards the operator,) an electrical current from

west to east, or from left to right, below the magnet. The same is true for the south pole.

We conclude that the effects of a magnet upon a coil of wire may be represented by an electrical current at right angles to the direction in which the wire moves upon the magnet, and directed below the magnet from west to east when the coil is moved from the south pole to the north pole of the magnet, and vice versa, the poles of the magnet being turned to the south.

The denominations will change of course if it be considered more convenient to turn both poles to the north.

It would seem easy to bring the facts relating to the removal of the keeper upon which wire is coiled, under the same expression. In that case the magnetism is in motion with respect to the coil, leaving the soft iron which forms the keeper.

With fifteen turns of copper wire upon the prismatic keeper of the magnet before used, a vibration through twenty degrees, at the maximum, was produced; beyond this the power of the current could not carry the needle. The wire was wrapped with silk.

With five turns upon the same keeper a vibration through an arc of ten to twelve degrees was obtained.

The coil being at rest upon the magnet no permanent deflection is produced. This agrees with an observation of Nobili and Antinori.

The amount of vibration may easily be increased by providing two coils, one for each pole, the direction of the coils being opposite to each other, the outer wires of each coil being united as well as the inner ones, the effect of two coils would be produced. They may be separated by a piece of wood, to which being attached, and the wood provided with a handle, the coils may be removed or replaced very conveniently.

Fig. 3.

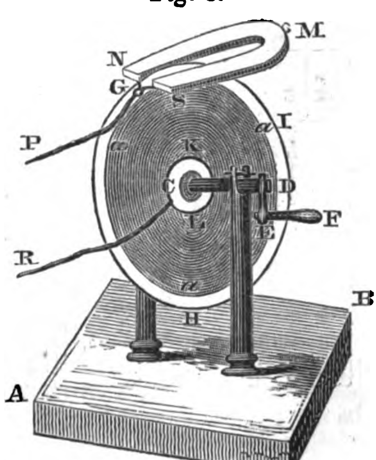


Fig. 3 represents Faraday's wheel; G, H, I, being a piece of copper 12 inches in diameter, the circular ring between G, H, I, and *a*, *a*, *a*, is amalgamated, also the ring K, L, near the centre of the plate on the same side with the first ring; the wheel is mounted upon an axis C, D, and turned by a winch. K, L, and G, are plates of copper, to apply the one at the amalgamated ring around the axis, the other at the ring at the circumference and between the poles, N and S, of a horse-shoe magnet. G, P, and C, R, are the wires soldered to these plates, their extremities connected with the galvanometer as described above, their length adjusted upon the same principles.

In experimenting with Faraday's wheel, the disk K, L, at the centre was pressed constantly against the wheel by fastening a cork between the disk and the support. The piece of copper G was touched to the wheel at intervals so as to assist the vibrations or to destroy them at pleasure. When the wheel was first amalgamated, a deflection in the needle was produced without the aid of the magnet; afterwards no such deflection was observed. Opposite rotations of the wheel produce opposite effects in deflecting the needle of the galvanometer, other parts remaining the same.

Meteorological Observations for May, 1832.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches.				Inches.	
	1	44°	63°	29.84	29.80	37	W.	Breeze.		Cloudy—flying clouds.
	2	43	63	.96	.93	37	NE. W.	Light.		Clear day.
	3	41	66	.93	.93	40	SE. S.	Calm.		Lightly cloudy—clear.
	4	47	76	.80	.70	61	SE. S.	Blustering.	.13	Light clouds—clear—rain
	5	61	59	.50	.60	46	W. NW.	Moderate.		Cloudy day. [in night.
	6	45	67	30.60	30.10	37	NW. SW.	do.		Lightly cloudy—clear.
☽	7	42	67	.25	.25	34	SE.	do.		Foggy—clear.
	8	48	76	.20	.10	54	SE. S.	do.		Cloudy—light clouds.
	9	56	72	.10	.10	57	S. W.	Breeze.	.25	Rain—cloudy.
	10	52	74	.20	.25	34	NE. SE.	do.		Light clouds—clear.
	11	42	68	.35	.40	29	NE. SSE.	do.		Clear day.
	12	42	75	.20	.30	52	SE. SW.	do.		Clear day.
	13	50	78	.10	.20	55	SW.	do.		Clear—overcast.
☉	14	60	80	.00	29.95	63	S.	do.		Cloudy—showery.
	15	64	62	29.83	.74	64	S.	do.	.50	Showers—rain.
	16	54	78	.74	.80	50	W.	Blustering.		Lightly cl'dy—fly'g. cl'ds.
	17	55	79	.99	.90	49	NNE. W.	Moderate.	.09	Clear day—rain in night.
	18	59	78	.80	.80	59	SW.	do.	.03	Cl'dy—fl'g cl'ds.—rain n't
	19	57	84	.60	.70	65	SE.	Blustering.	2.00	Cl'dy—fl'g cld's—thund.
	20	57	56	.60	.60	56	SW. W.	Moderate.	.17	Cl'dy--showery. [r'n. hail.
	21	46	68	.60	.64	33	W.	Blustering.		Clear day.
☾	22	47	71	.83	.83	34	W.	Moderate.		Clear day.
	23	48	60	.90	.90	43	SSE. E.	do.		Light clouds—cl'dy—rain.
	24	45	46	.70	.70	43	E. E.	do.	1.15	Rainy day.
	25	43	64	.89	.80	40	NW.	do.		Cloudy—flying clouds.
	26	44	58	.70	.60	54	NW.	do.	.65	Clear—rain.
	27	44	64	.40	.50	35	W. NW.	do.		Clear—flying clouds.
	28	45	66	.70	.75	44	W.	do.		Clear—flying clouds.
⊗	29	50	79	.84	.90	44	W.	do.		Clear day.
	30	56	56	.60	.90	53	W.	Blustering.		Rain—showery.
	31	46	57	.55	.50	46	E.	do.	.45	Rain—cloudy.
	Mean	49.47	66.77	29.85	29.87	46.7			5.42	

		Thermometer.	Barometer.
Maximum height during the month,		84. on 19th.	30.40 on 11th.
Minimum	do. . .	41. on 3d.	29.40 on 27th,
Mean	do. . .	58.12 . .	29.86

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

AUGUST, 1832.

Suggested improvements in the Construction of Barker's Mill. *By* JAMES WHITELAND.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

New York, June 5, 1832.

SIR,—The accompanying is a drawing* of what I consider an improved form of Dr. Barker's mill: you will very much oblige me by giving it, and the following description, a place in your journal.

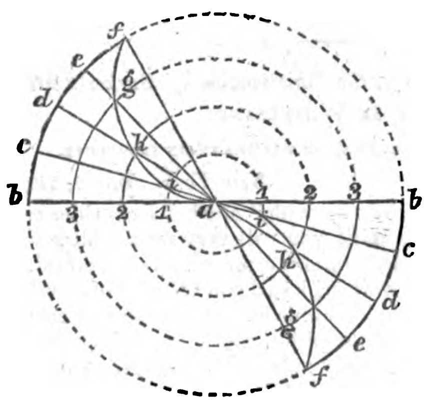
The mill is represented as working a little off the wall of a building. At the top of the drawing, and behind the bevel wheels, a cast iron wall-plate is shown, for fixing the pillow block into which the horizontal shaft (for working machinery inside of buildings, on which the upper bevel wheel is fastened,) turns. On the under side of this plate a cast iron trough, for conveying water into the mill, is fixed; the trough terminates in a cylinder just so small in diameter outside, as to work clear of the inside of the upright cylinders of the mill. This cylinder is so long, and the holes at bottom are so shaped as to admit the water with the velocity, and in the direction, of the water in the upright cylinder of the mill. Inside of the trough cylinder is a smaller cylinder through which the upright shaft works: at the top is a larger part for holding brasses for steadying the shaft. Under the trough cylinder is the cylinder of the mill, made of wood, and hooped as shown. At the bottom of this cylinder the arms of the mill are fixed; they are of a *curved form*. Behind the mill is a niche for the arms to work in. At the bottom of the niche is a circular trough

* See cut on page 76.

higher round its outer edge to receive the water after it has escaped from the mill: it is shown by the two ellipses at the bottom of the drawing. Below the mill is seen a square pit, for holding the step, into which the foot of the upright shaft works. The other parts of the drawing will be so easily understood as to make further description unnecessary.

The *curved form* of the arms is what constitutes the difference of this and Dr. Barker's plan of the mill. The curve is such, that the water will run from the centre to the extremity of the arms in a *straight line* when the machine is working: by this arrangement no centrifugal force is given to the water, as it has not received any rotatory motion from the arms; which it would have had, had the arms been straight.

The nature of the curve *f, g, h, i, a,* of the arms will be understood by the annexed diagram. Let *a* be the centre, and *a b* the distance to the centre of the upper stone from which the water flows; also let the concentric circles 1, 2, 3, divide this distance into equal parts; and take *b, f,* equal to the distance that the extremity of the arms would pass, in the time that a particle of water would flow from the centre *a*, to *b* the extremity of the arms. Divide *b, f,* into the same number of equal parts that the distance *a, b,* is divided, and from these points, let the lines *ca, da, ea,* be drawn to the centre. Now, since the motion of the water is uniform, and the motion of the arms uniform also, while the arms revolve from *f* to *e*, a particle of water leaving the centre at the time the arms were at *f*, shall have passed from *a* to 1; and the points *i* and 1 will coincide; also when the arms move from *f* to *d*, the water shall have passed from *a* to *h*, and the points *h* and 2 will coincide; and so for the other points: when the water arrives at 4, the point *g* in the arms will coincide with 3; and when the particle moves to the point *b*, the arms will have passed also to the same point, and *f* and *b* will coincide.



Since by this arrangement there is no additional motion given to the effluent water by centrifugal or any other force, till the velocity of the extremity of the arms becomes greater than the velocity of the water, all that we have to consider in estimating the power of this machine when working at any velocity less than that of the water, is the effect that a quantity of water, having the velocity that a body would acquire in falling from the top of the mill to the level of the jet holes, would produce, when working at different velocities.

The weight that will stop the mill must be equal to the weight of a column of water twice the height of the water in the mill on a base the sum of the areas of the pit holes. For it is evident that if the holes be shut up there will be a pressure on all sides equal to the weight of the column in the mill; let, now, the holes be opened, the pressure on the opposite side will remain as formerly, and the water being set in motion by an equal pressure, the reaction, (since action and reaction are equal and contrary,) will give another pressure equal to the former one, on the sides opposite the holes. Therefore these two forces will give a pressure equal to the weight of a column of water twice the height of the water in the mill, on a base equal in area to the sum of the areas of the pit holes.

When the mill is working at the velocity of the water, it will raise a weight, equal to the weight of a column of water, the same height as the water in the mill, on a base the sum of the areas of pit holes; and the effect will be a maximum, and equal to the whole power of the water. For it is evident that as the water flows with the same velocity as it did before, the force of reaction will remain as great as ever, and will just balance the above weight or one-half of the weight that will stop the mill. And the other force being caused by the pressure of the water on the areas opposite the holes, must cease when it has brought the velocity of the mill up to the velocity of the water, as this is as quick as the water can follow it. Therefore, with two forces, one to balance a weight equal to the pressure on the areas opposite to the holes, and the other to keep this weight in motion at the velocity of the water, an effect equal to the whole power of the water will be produced. For in the time that the water flows with the velocity that it left the mill, a length equal to the height of water in the mill, this quantity of water, or an equivalent weight, can be raised to the top of the mill.

The effect for the other velocities may be determined in the same way. When the velocity of the mill becomes greater than the velocity of the water, if there is no centrifugal force the weight that the mill will work with must be the force of reaction, minus the force required to carry the water round with the mill.

If the above theory is correct, I need say nothing of the advantages that this form of the machine has over the other forms, as, indeed, over every other water mill. By considering how much power remains in the water after it has escaped from the mill, when working at different velocities, the same results may be obtained; an additional proof of the correctness of the above theory: thus, when the mill is standing, the water escapes with its whole force and no effect is produced. When working at the velocity of the water the mill moves as quick as the water, and the water, after it has escaped, has no motion in any direction, but falls directly down. Now, since there is no power remaining in the water, its whole power must be spent in producing an effect equal to its power in keeping the mill and resistance in motion. The power when the mill is working at one-half, or any other velocity, may be determined in the same way. As the motion of the mill is just as quick as that of the water, the

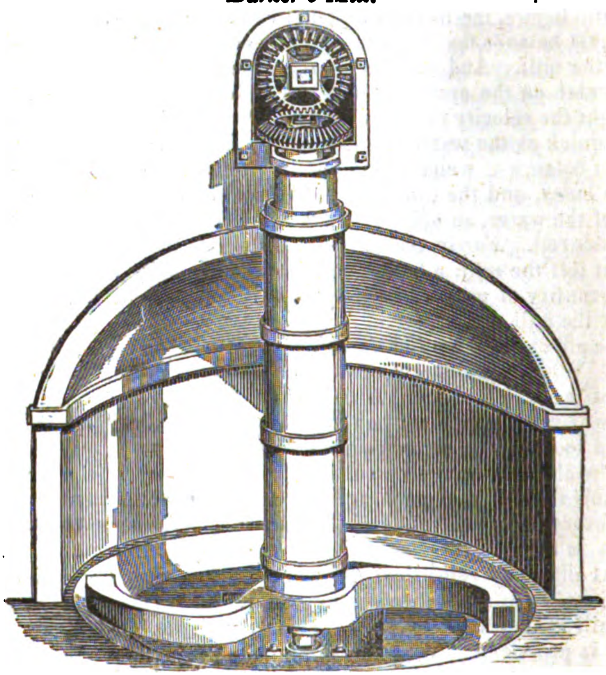
portion of the circumference b, f, must be taken equal to the length of the radius or arms, if the areas of the holes and arms are alike: if the holes be smaller than the arms, the portion b, f, must be longer in the same proportion, as the water moves slower along the radius.

A rotary steam engine might be made in this way by sending steam through a mill working inside of a condenser. The steam pipe might be connected to the steam wheel by a metallic packing. If the wheel was large in diameter, there would be very little friction, as it would require so small a pipe in proportion to the power of the engine. The power might be taken from the steam wheel, and the motion reduced by letting the axis of the wheel rest on friction rollers, and the power taken off the axis of the rollers by means of toothed wheels, or other rollers. Another method would be to force water or any other liquid through a machine of this sort by steam.

Yours, &c.

James Whiteland.

Barker's Mill.



FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Remarks on the Explosions of Steam Boilers. By John D. Ward, *of Vergennes, Vermont.*

The June No. of the Journal of the Institute contains a letter from Thos. Ewbank on the causes and means of preventing explo-

sions of steam boilers. In the course of his remarks he mentions a safety pipe (which is only a modification of the contrivance known among workmen by the name of "a feed head,") and gives an account of one on board the steam-boat M'Donough, on lake Champlain, which is inaccurate in some of its details.* As the engine was made by John D. Ward & Co. of Montreal, designed by myself, and built under my superintendence, I beg leave to set Mr. Ewbank right in the following particulars. The engine was built and set to work in 1828, and the safety pipe, or feed head, formed part of the original design, and was *not afterwards added;* its height was originally about thirteen feet, instead of twenty, and it was not intended that the engine should ever be worked with a greater pressure than four pounds per square inch; however, during the ensuing winter an ignorant engineman persuaded the proprietors of the boat that the boilers were sufficiently strong to bear a much greater pressure than had been used, and that it was only necessary to raise the feed head to enable him to double the pressure. His representations induced them to order the necessary pipes for that purpose from our foundry at a time when I was absent in Europe, and I learned with regret on my return that the engine was then at work with nearly twice the pressure of steam for which it was originally intended. The feed head is now about eighteen feet high, and may have been plugged up on some occasions; for the same ignorance and recklessness of consequences which led to raising it would lead to plugging it also; and both the one and the other having been done by the same person with impunity, his temerity will probably only end with his life.

I beg leave further to remark that the apparatus was neither expected nor intended to serve as a safety pipe any further than to prevent the engine man from using a greater pressure of steam than the engine was designed for, and they never can be made to supply the place of a safety valve for relieving a boiler from an extra pressure of steam without being of a size that will be found extremely inconvenient in practice, as every man will readily see who understands the subject.

With regard to the causes of explosions which have happened, and the means of preventing them in future, I think a great deal more ingenuity has been exercised than was called for by the difficulties of the case, especially in seeking for the causes of them. The real cause of nearly, if not quite, all the explosions that have happened, was a dangerous and unnecessary pressure of steam; amounting always to from fifteen to one hundred and fifty pounds, or upwards, per square inch.

The consequences which have resulted from using such pressure is a sufficient proof that it is dangerous; and that it is unnecessary is evident from the fact that a well made steam engine may be worked

* There appears to us to be a strict accordance between the facts stated by Mr. Ewbank, and those given by Mr. Ward: as we understand Mr. Ewbank, he says that the pipe *was* put to the boiler in 1828, *was* afterwards lengthened, and its height *is* now about twenty feet.—Com. Pub.

more economically with four pounds per inch than with a greater pressure. Hence if a certain amount of power is required on board a steam-boat it will be better to use a large engine and low pressure than a small engine and high pressure, because in the first place the low pressure is perfectly safe, and in the second place it is the cheapest. Perhaps the last position may be disputed, and it may also be said that the weight of the larger engines will be so great as to prevent the boats from having the great speed so desirable at the present day. To the first it may be replied that any addition to the first cost will be more than compensated by the subsequent saving in the cost of fuel. And to the second, that the weight of the fuel saved in a passage of any considerable length will be more than any extra weight required in the engine.

With regard to the means of preventing explosions, I think no new invention necessary unless it be some plan to prevent persons from meddling with what they do not understand; for if a steam engine is properly made, the boilers furnished with safety *valves* of sufficient dimensions, and weighted to rise when the pressure of steam is four pounds per inch, there can be no more danger in using it than in using any other machinery of equal magnitude. But to insure the proper construction and management of them some legal restraints must be imposed. And I see no reason why the man who builds steam engines for *passage boats*, and he also who manages them, should be exempt, any more than a physician or a lawyer, from giving good evidence, to competent judges, that they understand their business, and some pledge that they will make a right use of their knowledge.

Method of Tinning Cast Iron, &c. *By* Isaiah Lukens.

TO THE COMMITTEE ON PUBLICATIONS OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Gentlemen,—Having frequently tried the following process for *tinning cast iron*, and having found it very easy of execution, and certain in its operation, I am induced to offer it for the benefit of those of your readers who may have occasion to use some process to effect the same purpose. This method is applicable to all sizes of castings.

The surface of the casting is first to be made perfectly clean, by turning, or scraping away the outside. Filing does not answer as well as turning or scraping.

Make an amalgam of tin with mercury, containing enough tin to form a soft solid, say of the consistence of butter at 60°.

Prepare a dilute solution of muriatic acid; the muriatic acid of the shops diluted with about an equal weight of water, will give an acid of convenient strength.

Heat the casting until so warm that on a further addition of heat it could not be held conveniently in the hand. Dip a clean linen rag into the dilute acid, and wash with it the surface of the casting where

it is to be tinned. Upon another piece of clean linen take up some of the amalgam, and pass it over the surface which has been wet by the acid.

A portion of the amalgam adheres; by rubbing the tin is precipitated upon the surface of the iron to which it is united, and the surface is tinned; after which the article should be immersed in a bath of melted tin and rosin to perfect the coating.

The explanation I take to be this. The diluted acid, aided by heat, acts upon the casting, forming a chloride of iron; when the amalgam is presented to this, the chlorine leaves the iron to combine with the mercury, and the iron and tin are precipitated in very intimate union if not in chemical combination. I do not mean to lay particular stress upon this explanation, the steps of the process are detailed just as I have frequently taken them.

It may not be amiss, while writing to give an illustration of a method of making available for purposes of art the polish which nature presents in some melted solids. The polish of a clean surface of an alloy of melted tin and lead is very beautiful. Suppose it be desired to fix this upon a tube of copper or iron, as upon the iron spouts attached to tea kettles of tin. The tube is, if of copper, to be prepared in the usual way, and, if of iron, to be well tinned by the method just given, (or any equivalent one.)

Dip the tube into a vessel of a melted alloy of tin and lead, and allow it to remain until thoroughly heated. On withdrawing the tube the liquid metal runs down the surface. Pour rapidly *into* the tube cold water. The metal will immediately fix upon the outer surface, retaining the polish which it had when liquid.

Yours, &c.

Isaiah Lukens.

FRANKLIN INSTITUTE.

Note of the Committee on Explosions, acknowledging the receipt of a communication from John S. Williams, of Cincinnati, Ohio.

The committee on explosions acknowledge the receipt of the letter from Mr. Jno. S. Williams, requesting their consideration of a paper containing "some propositions and suggestions on the means of obviating or lessening the accidents incident to steam navigation," and inserted in the Journal of the Franklin Institute, vol. viii. p. 289. The typographical errors named will be corrected.

Explosions of Steam Boilers.

[Continued from p. 9.]

Supplement to the Communication of Thomas Ewbank, *to the Committee on Explosions.*

New York, June 23, 1832.

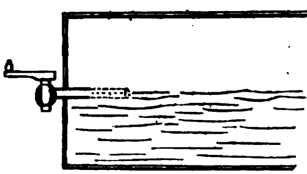
Gentlemen,—I take the liberty to submit the following remarks as supplementary to my second communication.* Want of time prevented me from including them in my last. It was my intention to test these, as well as certain other devices, by experiment, previous to troubling you with them, but other engagements have hitherto prevented the accomplishment of that purpose.

First, in relation to gauge cocks as indicators of the level of the water within a boiler.

The inaccuracy of the common gauge cock as a means of detecting the true height of the water in a boiler, arises chiefly from two causes: firstly, from the agitation of the water while steam is being withdrawn from the boiler to supply the engine, or through the safety valve: and secondly, from the current, or rush of steam, produced towards the aperture of a gauge cock when it is open; in consequence of which, the water, though previously at rest, and below the opening, is agitated and carried out through it.

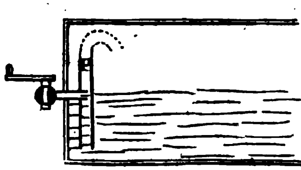
These defects are illustrated by Mr. Peale, in the eighth volume of the Journal of the Institute, page 147.

The last mentioned defect may be lessened by a perforated tube, five or six inches long, (see the accompanying cut,) attached to the end of the cock which is within the boiler. Such a tube would prevent the current from being concentrated towards the aperture of the cock, as the steam would enter it through the small openings in various directions. The small holes would, however, be liable to be filled up by dirt, &c. which so frequently chokes the common cock.



The next figure shows a method by which both the defects to which I have alluded as affecting the gauge cock, may be remedied.

The cock passes through the head of the boiler in the usual way, and is then united to a perpendicular pipe P, open at both ends, and about two or three inches in diameter. The lower end of the pipe is four or five inches below the surface of the water, and its upper end is carried as far above that level as may be convenient. This end may also be turned over, as represented by the dotted line, to prevent dirt, &c. from being thrown into it by the agitation of the

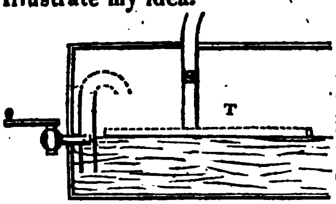


* Journal of Franklin Institute, page 1, vol. x.

water. When this cock is opened no current can be formed in the direction of its aperture, and the water in the tube P, (which will of course be at the general level of the water in the boiler,) will not be so subject to agitation. This cock will, moreover, not be so liable to be choaked as the common one.

It would appear that as the agitation of water in a boiler is caused by withdrawing the steam from it, this agitation might in some measure be prevented by a different mode of adapting the steam pipe to the boiler.

If the pipe could be so adapted as to allow the steam to press down towards the surface of the water, when entering the pipe, instead of (as in the usual way) ascending from the water, then the steam would have the same tendency to preserve the water at rest, which, by the present mode, it has to agitate it. The annexed figure will serve to illustrate my idea.

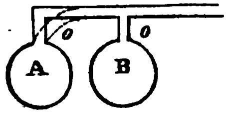


Suppose the steam pipe S to descend into the boiler until within two or three inches of the surface of the water, and then to be connected to the horizontal pipe T, which is perforated with small holes on its upper side only. The steam, as it enters this pipe, would have a direct tendency to preserve the water from rising, because the direction of the pressure would be then opposed to it. It may, perhaps, be supposed that in consequence of the position of the pipe with respect to the water, a portion of water will escape through the pipe with the steam, but if the steam in entering the pipe prevents the water from rising, I do not see how such an effect can be produced; and from the observations which I have made on the use of the float, (described in my last communication,) which in its first modification was liable to the same objection, I am inclined to believe that in this case there will be no such difficulty, and that the effect supposed can only take place by the careening of the boat, &c. Were the openings made in the lower side of the horizontal pipe, then, probably, as much water as steam would pass through them.

This mode of perforating on the top is applied to the gauge cock in the same figure, its end being closed, and the opening made on its upper side. This appears to me to be preferable to the usual opening in the end, as a less decrease of water will be detected by it. Besides, I do not see how the water (if previously below the opening,) can rise into it when the cock is opened for a short, or indeed for any, length of time, as is the case in the common gauge cock. (See Mr. Peale's account before referred to.)

Second, in relation to the steam pipes of connected boilers.

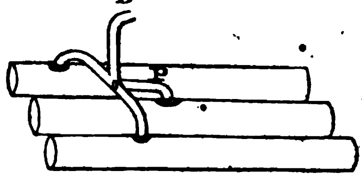
The method of connecting steam pipes to boilers, where more than one is used, is frequently the cause of a more rapid consumption of water in one boiler than in another; and affords a further reason for feeding each boiler with water separately. Some boilers have their



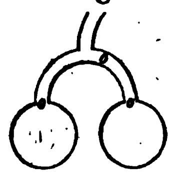
steam pipes, (as in the cut,) connected to them at right angles: the consequence of this is that more steam escapes from B than from A when B is nearer the cylinder of the engine, and the steam has the same facility of escape from it as from A. Others, again, have the pipe from A curved, as represented by the dotted lines, and by this mode more steam is consumed from A than from B.

The proper mode would appear to be, to make the tubes *o*, *o*, of the same length, curvature, and diameter, before terminating in the steam pipe, as in the annexed figure, C. Where more than two connected boilers are used, the tubes should be arranged as shown in the figure D. The branch P, from the centre boiler, should be placed so far back of its junction with the others, as to make its length equal to that of each of these.

D



C



These remarks may very possibly be of little or no value, but as they are the result of observations made at different times, I have thought it right to submit them, with all their imperfections, to the enlightened judgment of the committee.

Very respectfully,
THOMAS EWBANK.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN FEBRUARY, 1832.

With Remarks and Exemplifications, by the Editor.

1. For a machine for *Washing and separating Gold from earthy matters;* Thomas Rives, Hall county, Georgia, February 3.

This machine operates upon the principle most commonly adopted in similar structures, presenting little novelty that we perceive, excepting in its being the first patent for a gold washing machine from Georgia, whilst all the other states through which the gold region extends, have previously sent their contributions to the patent office.

A long trough is to be made something like a horse trough, and this is to have bars of iron across it, which whilst they allow the finer particles of matter to pass between them, keep back the coarser. The earth to be washed is put into this trough, and water from a stream admitted at one end of it, by which the gold and other matter washed out, falls into a second trough standing at the other end. This

second trough has three or four partitions dividing it into separate compartments, which have agitators in the form of rakes, moving in them. The washings run through these several compartments, there being notches in the upper edges of the partitions for that purpose. The washing is further continued by putting the part containing the gold into another trough, suspended by ropes, having also a stream of water running into it, and being kept in constant agitation. A small water wheel, or any other adequate power, is employed to give motion to the respective parts.

The whole apparatus we think belongs to the infancy of the art, being but little calculated to save the finer particles of gold; a defect common to most of the machines which have been patented for the same purpose.

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2. For a *Cheese Press;* John Holmes, Paris, Oxford county, Maine, February 6.

This is quite an old fashioned press, its action being dependent upon two eccentric wheels. There is a frame made with cheeks in the usual form. A shaft, hung on pivots, crosses the upper part of this frame, from cheek to cheek; upon this shaft there are two eccentric wheels, and upon the upper side of the follower two friction wheels, or rollers, upon which the eccentrics have their bearing. For the purpose of making continued pressure, weights may be hung upon a lever extending from a hole in the shaft carrying the eccentric wheels.

There is no claim made, nor indeed does the specification contain a description of the machine, dependence being placed upon the drawing only, which gives a full view of the instrument.

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3. For an improvement in the mode of managing heat for warming rooms, called the *Fuel Saver and Economical House Warmer;* Robert B. Varden, city of Baltimore, February 6.

There are so many things in the plan here described which have been heretofore applied, and some of them patented, that we cannot tell precisely what is intended to be claimed as new, the patentee having presented the whole, and then informed us that what he claims "is the before described mode of managing heat, by which rooms are warmed, and cooking performed from the caloric that usually escapes with the smoke through the flue of the chimney."

The fire place is to be of cast iron, made in one piece, and set into the brick work so as to leave a hollow space behind the back and jambs. Into this hollow space air is to be admitted from the cellar, or from out of doors, whence, being heated by the fire, it is to pass through proper openings into the room. Above the fire place a hollow cylinder of iron is to cross the flue: cold air is to be admitted into this also, and in like manner, when warmed, is to escape into the room. Brass or other tubes are likewise to conduct heated air from chambers under the hearth, and into a room above.

The apparatus denominated the economical warmer operates in the

manner of the drum attached to stove pipes, and is to be fixed in an upper apartment, against the flue of the chimney. When it is used, a damper is made to close the flue, and cause the smoke and heated air to pass into, and through the warmer, which may be made of sheet metal, in any form, having cross tubes opening into the room to expose a larger surface to the heating process. A damper in the flue, or in the pipe above it, which returns into the chimney, serves to regulate the draft.

Besides the opening from the cellar admitting air behind the jambs, &c. there is another through the middle of the hearth, to supply a draft to the fire. Several appendages which we have not noticed are mentioned and figured; but the general plan has been described, and we leave it to those who have given attention to the different apparatus which have been devised for economising heat, to discover what there is of novelty in the principle, or in the arrangement of the foregoing *invention.*

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4. For an improvement in the method of *Setting the teeth of Mill Saws;* Norman Urquhart, Madison county, Alabama, February 7.

The two lower teeth of a mill saw are to be set "one-quarter of an inch wide, and three-eighths of an inch from the edge of the tooth in towards the blade." When this has been done, a tooth is to be marked, the distance of which from the bottom of the saw is equal to four times the length of the crank; neither this tooth nor any of those above it are to be set, but the teeth between this and the lower teeth are to be set so that their points will just touch a straight edge laid on each side of the saw, from the marked to the wide set tooth at bottom. The set of the teeth will thus decrease regularly in width from the bottom to the marked or unset tooth.

The patentee says that when thus set a saw will cut with increased speed and power, whilst it will run perfectly free from all side friction.

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5. For an improvement in the *Duster for cleaning Rags;* George Camel, Manchester, Hartford county, Connecticut, February 7.

The machine upon which this is an improvement was patented on the 27th of July, 1831, and is described in vol. ix. p. 60. The improvement "consists in surrounding the shaft of the duster for cleaning rags with a drum, and giving the drum and shaft a more rapid motion than the screen, so that the rags may be more easily cleaned." The instruction given for regulating this motion is so to apply the power, that whilst the shaft turns about seventy-five times in a minute, the duster shall turn about thirty-seven times, and both in the same direction.

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6. For an improved *Tobacco. Press;* George Booker, Richmond, Virginia, February 8.

The frame and screw of this press resemble, generally, those in common use, but the seat, or bed, upon which the keg, or box, is placed, instead of being firmly fixed to the cheeks of the frame, has two strong gudgeons passing through holes in the cheeks, and consequently admitting of its being inclined forward or backward. In pressing tobacco into kegs or boxes as heretofore practiced, much inconvenience has been experienced from their liability to burst in consequence of the great pressure, and the inadequate means pursued of bracing or supporting them. The principal part of the present invention consists of an apparatus for avoiding this difficulty. A cast iron case is made, of suitable form and size for containing the box, or keg. This iron case is made to open by a proper hinge joint, and has contrivances for holding it securely together. Plates of metal fill up the space which may exist between the keg or box and the cast iron case, and these are forced up by screws working through the latter, whilst the whole is so contrived as to be at once seated centrically under the screw, and thus to insure the regular action of the press. The turning of the bed piece facilitates the placing, removal, or examination of the article under pressure.

The whole apparatus is clearly described, well represented, and will certainly answer the purpose intended.

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7. For a *Churn;* Jonathan H. Bruner, M'Kean, Licking county, Ohio, February 9.

We have had a truce with churns for some time past, and regret that in again introducing one to our readers, we are compelled to say that the character of novelty which is claimed for it, cannot be sustained. The body is that of the common vertical churn; it has a vertical shaft with pins, or dashers, projecting from it, which, as they revolve, pass between other pins, or dashers, projecting from the sides within the churn.

The shaft has a pinion on its upper end which is acted upon by a crown wheel, turned by means of its horizontal shaft and crank. The dashers, and the mode of operating, are perfectly familiar.

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8. For a *Pump,* called by the patentees "a labour saving rotary gate purchase;" Levi B. Gitchell and Joseph Musser, Canton, Stark county, Ohio, February 11.

Although this contrivance is called labour saving, it is certainly one of those to which we might resort if we desired to gear a pump in such a way as would prevent its working with too much ease. It is proposed to use two barrels, constructed in the usual way; the *novelty* consisting in an old and long exploded mode of working the pistons. This is to be effected by means of a double rack and pinion acting upon each rod, and made in the way so frequently proposed for getting rid of the crank motion in the steam engine. There is a vertical frame having teeth upon each of its inner sides, and into these teeth, the leaves of a pinion are to take, the frame shifting from side to side as the piston is to be raised or lowered. There being

two pistons, there must be two such frames, and two pinions on the horizontal shaft by which they are to be worked.

In order *to increase the power*, a pinion, turned by a crank, gears into a cog wheel on the end of the shaft, and we are told that in this way the power may be increased in any degree; but it seems to be altogether forgotten that the friction is also increased, and the velocity diminished in the same proportion. The patentees seem to consider the whole apparatus as new, they having described it in all its parts, without making any claim.

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9. For an improvement in the *Construction of the Dry Dock*; David Brown, city of New York, February 11.

A particular description is given of this dry dock, without any designation of those parts which are considered as new. As the patentee is a practical ship builder, he is undoubtedly aware of what has been heretofore done in this species of naval architecture, though not of the requirements of the patent law, which direct the patentee to distinguish his invention from every thing which has been before known or used.

This dry dock is to be built of timber, and is to be fastened between two piers, and sunk down so that its top shall be above the highest tides. A steam, or other engine, is to be used to free it from water. Its sides are to flare out about four inches to a foot, and there are to be diagonal braces within, from the bottom to the sides, which are to be so planked as to form steps, serving the purposes of the workmen, and lessening the capacity of the dock for containing water. The gates which enclose the vessel are to be about twenty-three feet from the outer end of the dock. The object of placing them there is to have double gates, one pair being near the end, that they may be closed whenever the inner or main gates required to be repaired.

The patentee designates the number and size of the main timbers to be used, and with this kind of description closes his specification; in these particulars we do not think it necessary to follow him, there not being any thing special, or peculiar, excepting what we have given above. The general plan is certainly not new, although the patentee could undoubtedly have pointed out many parts which are so.

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10. For a *Washing Machine*; Silvanus Hathaway, Massillon, Stark county, Ohio, February 13.

The claim of the patentee will afford a tolerable idea of the nature of this invention; it is as follows:

"What I claim as my invention, and for which I ask a patent, is the general plan and arrangement of the machine as described, namely, the placing of a shaft horizontally, which shaft is to be turned by a crank, and has on it a fluted roller, which, by its revolution, causes a circular tub, or trough, to revolve upon its vertical axis. The bottom of said tub, or trough, being also fluted and elevated towards the centre so as to adapt it to the conical roller. I also claim the em-

ployment of a spiral spring, or of a weight, acting upon the outer end of the horizontal shaft to press it and its roller down, and at the same time to admit of its rising according to the varying thickness of the clothes between the two surfaces."

The only washing machine which bears any strong resemblance to this is one patented by John Hall, April 20, 1831, and described vol. viii. p. 163.

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11. For an improvement in the *Machine for Pressing Flour, &c.;* Silvanus Hathaway, Massillon, Stark county, Ohio, February 13.

In this press the lever which forces down the follower upon the flour, is raised by means of an endless screw, working against the end of its longer arm. The concave nut in which the screw works does not embrace it, but is a segment of a female screw, so fixed that it can be thrown out of gear when the lever is raised to the required height. The claim is "to the employment of an endless screw upon a vertical shaft, which, by its revolution, raises the piece containing the segment of a female screw, and thus operates upon the packing lever in the way described; and to the manner of disengaging the said piece when required."

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12. For a *Machine for Dressing or Picking Stone or Marble;* Clark Miller, jr., Williamsport, Lycoming county, Pennsylvania, February 14.

This machine is furnished with two or more picks, or chisels, which are placed on the end of a lever, hung like those of a tilt hammer, and like them raised by cams, or wipers. Springs are made to bear upon the levers, near to the picks, in order to quicken the blow. The whole machinery is fixed on a frame by which the operating parts can be shifted about. There is no claim.

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13. For a process for *Bleaching Bay-berry Wax, or Bay-berry Tallow;* Benjamin Gomperts, city of New York, February 14.

Five hundred pounds of the wax, melted, are to have added to them a solution of chloride of lime, consisting of three hundred pounds of the chloride, and three hundred gallons of water. The whole is to be kept heated, and stirred until the wax is nearly white. A mixture of nine pounds of vitriol, and six quarts of water, is then poured in, which, it is said, serves to separate the water from the wax; the latter is then to be dipped off. The same process is to be repeated, after which five gallons of salt are to be added, and this, we are told, completes the separation of the water from the wax.

It appears to us that if the bleaching of this wax cannot be effected by a more economical process than the foregoing, it will be found too expensive to come into general use.

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14. For a mode of *Fastening Handles on Hoes,* Shovels,

Axes, Hammers, &c. &c.; Reneer Dare, Greenwich, Cumberland county, New Jersey, February 14.

The hoe, or other tool, furnished with an eye, is to be passed on to the handle in the usual way. A piece of iron is to be forged with a shank and head, and to have a mortise through its shank to receive a key; the head is to be larger than the eye in the hoe, or other tool. The shank of this nail, or bolt, is to be let into the handle, so that the head of it may bear against the eye of the tool; a key is to be passed through a mortise in the handle and that in the inner end of the bolt, which thus confines the tool in its place. There must be a ferule driven on to the handle, reaching from the hoe to the mortise hole that the key may bear against it.

Did the patentee never see pitch forks fastened into handles by a key through a mortise in the shank and handle, a ferule being first driven on to the latter? This, it is true, makes but one half of his invention, there being no broad head required.

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15. For a *Washing Machine;* William M'All, Hiram H. Higgins, and Reuben G. Rodgers; Athens, Limestone county, Alabama, February 15.

A trough with rollers on the bottom, forming together a hollow segment of a circle, has a convex segment formed of slats, suspended upon a spring above it, and between these two parts the clothes are to be rubbed until clean. After being washed they are to be passed between two wooden rollers, fourteen inches long and six in diameter; these are to squeeze out the water, and obviate the necessity of wringing. That the goodness of this invention may be known, the patentees shall speak for themselves; they say, "The foregoing described machine differs from all others in this, that the lower segment contains rollers and is stationary, the upper segment contains slats and is suspended from a spring. The spring is new, and also the cylinder press." But for the above assurance we should have doubted the novelty of some of the parts pointed out, and we still apprehend that the patentees have not seen the whole of the one hundred and fifty washing machines which have been patented in the United States, to say nothing of those in other countries.

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16. For a *Shingle Sawing Machine;* Duncan M'Arthur and Thomas M'Kibbin, Urbanna, Champaign county, Ohio, February 15.

The general arrangement of this shingle machine resembles that of some others. The block is to be placed upon a carriage which is moved up to a circular saw by a rack and pinion. There is an apparatus for canting the block to give the shingles their proper slope. The parts designated as new are those by which particular movements are made, and these would require the drawings for their explanation, which, although they appear to be very well conceived, we do not think it necessary to give, as others equally good could be readily contrived by any skilful mechanician.

17. For an improvement in the *Still;* Jacob Miller, Lancaster township, Lancaster county, Pennsylvania, February 16.

This improvement consists in a particular arrangement of the head of the still, within which ascends a pipe or tube, about ten inches in diameter, up which the vapour is to pass; this tube reaches to about two thirds of the height of the head, it is covered with a cap, between which and the outside of the tube there is a space, through which the steam that rises is turned again downwards into the liquid, into which the open end of the cap dips to the depth of about two inches. A small supply tube passes up through the head, and near to one side of it; its lower end dips into the liquid, and through this last tube a fresh supply of low wines may be poured in, and the tube is then to be corked up.

There is no claim made.

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18. For an improvement in the *Percussion Gun Lock;* Israel J. Richardson, Palmyra, Wayne county, New York, February 17.

The specification of this patent covers upwards of twelve pages, and enters into a very minute description of the various parts of the lock, but a small portion of which, however, is shown in the drawing. An attempt is made to be minutely particular, but the writer has certainly 'darkened council with words,' without communicating knowledge. In this lock, percussion powder is to be used, as formerly, without caps, and there is some peculiarity in the mode of making the discharge. The chamber in which the powder is contained, is a box standing on the upper edge of the lock plate, and may be about one and a quarter inch in length. It is perforated from end to end; and two pins fit into these perforations, one passing in at each end. When the gun is to be discharged, these pieces are forced simultaneously in, and meet at the middle of the perforation, where they inflame the powder. One of them is forced in by a cock placed in the usual manner, and there is another lever, or cock, at the opposite end of the plate, to force in the other pin. A rod, or stirrup, extends from one of these cocks to the other, causing them to act simultaneously.

The patentee claims all the advantages arising from the use of a gun lock constructed on the principle specified by him, and the various modes of action which he has intended to describe; we apprehend, however, that he has not succeeded in giving such a description as shall enable a workman to understand his principle, or reduce it to practice.

It will not be expected that we should give an opinion of the goodness of an invention which we have confessed we do not understand; this lock may be superior to others now in use, but we see nothing to warrant the conclusion that it is so.

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19. For an improvement in the *Mode of manufacturing Oil Cloths by machinery;* Deborah Powers, relict and administra-

trix of the inventor, William Powers, Lansingburg, Rensellaer county, New York, February 18.

The petition for this patent states that the petitioner has reason to believe that some person has surreptitiously obtained, or is about to obtain, letters patent for the machinery invented by her late husband; alluding probably to the patent granted to Otis Ferrin, of Lansingburg, and noticed at p. 323 of our last volume. The machinery here described is essentially the same with that of Mr. Ferrin, with the exception of the hopper, or trough, for containing the paint, which is not mentioned in the present patent, but it is stated that the size, oil, paint, or other material, to be spread upon the cloth, is to be poured upon it whilst stretched, and lying horizontally, and that as it is drawn through the machine, the gauge plate, or scraper, removes the superfluous material; and, in the course of from five to ten minutes, will leave a perfectly uniform covering upon a piece of cloth four yards in width, and thirty in length.

We hope that Mr. Ferrin has property enough to carry on his business to advantage by means of his machine, if he is the true and original inventor of it; or, if otherwise, to pay threefold damages to the fatherless children and the widow, if he has attempted to wrong them.

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20. For an improvement in the mode of *Cutting out Visors of Leather, and other materials, for Caps and Hats;* John Hoskins, Roxbury, Norfolk county, Massachusetts, February 20.

The apparatus described in the specification of this patent is, in its general features, similar to that noticed at p. 43 of our last volume, as patented by George Demitt, on the 20th of July, 1831. This patent is referred to in the specification, and the cutter used by Demitt is spoken of as a thing long known and used. The present patentee claims only to have made an improvement on that apparatus, by which the stamping, or embossing, of a pattern upon the edge of the visor is effected at the same time with the cutting. For this purpose a stamping tool, properly engraved, is fixed within the cutter, fitting close up to it, and standing sufficiently back from the cutting edge to allow the operation to be completed. This stamping apparatus is made adjustable to adapt it to leather of different thicknesses.

The claim is to that construction of the apparatus which enables it to cut, stamp, and deliver the visor at one operation.

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21. For an improvement in the mode of constructing the *Steam Engine;* Stacy Costil, city of Philadelphia, February 20.

The cylinder of this engine is to vibrate on trunnions at its centre, and the piston rod is to be passed through a stuffing box at each of its ends. There are openings for the admission and discharge of steam, at each end of the cylinder, and faced plates forming the valve seats, which are in the same vertical plane with a cross section of one of the trunnions. There are no steam ways cast on the cylinder, the steam being let on and off directly through these open-

ings on the faced plate. The stationary valve against which the faced plates vibrate, is a flat hoop, concentric with the trunnions, and sufficiently large in diameter to extend from end to end of the cylinder, and to cover the valve seats. This flat hoop is cast hollow, for steam ways, each hollow forming nearly a semicircle, but with stops between them to prevent their communicating with each other. On that face of the hoop which fits on to the fore plates there are four openings, two to each face plate, serving to let the steam on and off at each vibration. Steam, and eduction pipes, enter at the other, or outer side, of the hoop. This hoop is held up against the valve seats by a bar of iron which crosses it, and which is borne up by a screw. The claim is to the "holding the valve against the cylinder by mechanical power, the valve being stationary, the disuse of the steam chest, and the consequent simplicity of the whole arrangement."

There is no small resemblance between the action of this valve and that described by Mr. Halloway at p. 43, under the name of the wing gudgeon valve. In that, the openings are near to the trunnions, in this, the fore valve is extended so as to carry the openings to the ends of the cylinder: and what is a little singular, both these patentees make one of their claims to consist in "the simplicity of the whole," which simplicity is rather an unpatentable article.

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22. For an improvement in the *Machine for weighing heavy bodies;* Erastus and Thaddeus Fairbanks, St. Johnsbury, Caledonia county, Vermont, February 21.

The patent above alluded to is taken for an improvement on the weighing machine patented by the same gentlemen on the 13th of June, 1831. In speaking of that machine we observed that the general principle upon which it operated was the same with those which have been many years in use in England, and also in this country. There was some difference in the arrangement of the levers upon which the platform rests, and the patentees have since improved that arrangement, and made it the subject of a new patent.

Articles of this description require engravings for their illustration, there being but few persons who would clearly comprehend a mere verbal description.

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23. For a *Fanning Mill for cleaning Grain;* Peter Prine and Lott Huestis, Auburn, Cayuga county, New York, February 23.

This fanning mill has the usual appendages of such machines, and it would be difficult to tell in what it differs from some of those which have been already patented; this difficulty seems to have been felt by the patentees as well as by ourselves, for they have neglected to say any thing upon the point, and the instrument looks so much like its predecessors, as to lay no visible claim to originality. We suppose, however, that as there are two patentees, there must be at least two points of novelty.

24. For a *Portable Horse Power;* James K. Cory, Bethel, Clark county, Ohio, February 27.

We do not know why this is called a portable horse power, as it is not made locomotive. In its construction there is little, if any, novelty, it being the common mill in which a horse by walking round turns a vertical shaft, carrying a horizontal cog wheel. There are ratchet wheels to prevent a sudden check, by the stopping, or backing, of the horse; particular directions are also given relative to the size of the respective parts, and the materials of which they should be made. There being no claim, we are not aware of the points upon which the patentee relies to sustain his exclusive right, and we do not perceive any part which we should not feel free to use without thinking of interfering with the invention of any one living.

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25. For a *Cane Rifle;* being an improvement on rifles and guns; Roger Newton Lambert, Repton, Worcester county, Massachusetts, February 27.

Our readers are aware that guns, or rifles, in canes, are not new, but of course ingenuity may devise many novel modes of arranging the parts of such an instrument; that before us exhibits much skill, but still we think the instrument itself, however made, will never supersede the sportsman's gun, or rifle; and that for defence and offence, but few need it, and but few, therefore, ought to carry it. A truce, however, with moralizing; this belongs not to our present office, which is to tell how things are made, and not to assign moral reasons why they ought not to be used. As in many other cases, however, we cannot readily describe the peculiar arrangements of this cane rifle, although one point may be noticed which will be easily comprehended. The head of the cane draws back, so as to expose the lock, and then bends down upon a joint, assuming a form something like the butt of a gunstock. This is claimed, as is also the sliding of the barrel within the cane, for the purpose of retaining a cap over the muzzle, and the motion by which the cap, at the ferule end, is thrown off, when the piece is to be discharged.

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26. For a *Card to be used in manufacturing Water Proof Hats,* Richard Mills, city of Baltimore, February 27.

This invention is described as a felting formed in the usual way, and then stiffened with a composition consisting of "the whites of hen's, geese, turkey's, duck's, and Guinea fowl's eggs, mixed with oyster shell and stone lime, being composed of half of each." This felt then becomes the foundation for a card, to form which it is stuck with teeth, and nailed upon a board. We are told that it is then called a "hot-water-proof-raising-card, used in the manufacture of water proof hats."

There is certainly something rather queer in this description; the eggs of so many different fowls, and two different kinds of lime are prescribed; perhaps the patentee knows the *why*, although he has not given the *because* to us. Should the Guinea fowl's eggs be omitted,

will the cookery be spoiled? and if not, would the rights of the patentee be infringed by using a composition without it?

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27. For a *Compound Lever Balance;* Jared B. Wetmore, Rush, Monroe county, New York, February 27.

The instrument here patented is merely two combined steelyards; the specification does not even describe them, but descants upon the great power and utility of such an apparatus. Were it not for the drawing, therefore, we should have had but little idea of the form of this *very new* and useful machine. It is not the first time that we have called the attention of our readers to a patent for combined steelyards, and judging by the general course of things, it will not be the last, unless our career should prove to be a very brief one. The patentee has not claimed the particular arrangement of the instrument exhibited by him in his drawing; and where there is nothing new in the principle of, or the mode of action, in a machine, any claim made must be to some special, or particular, novelty of arrangement.

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28. For an improvement in the *Bark Machine;* James T. Gifford, Veteran, Tioga county, New York, February 27.

This machine is intended to cut bark instead of grinding it as is usually done. There is a circular cast iron plate, of suitable diameter, the surfaces of which are flat. In its centre a spindle is fixed, as this plate is the runner. Six or more slits, or openings, are made through this plate, extending from within two or three inches of its periphery towards the centre. Knives, or cutters, are fixed in the slits, and project above the surface of the plate, in a degree proportioned to the intended fineness of the bark, which as it is cut is to pass through the slots in which the knives are contained. This plate is to be placed within a suitable frame, with the lower end of the spindle resting on a step, and what the patentee calls a bar circle is placed immediately above the runner, so close as just to allow the knives to revolve under it. The bar circle has an appearance something like the framing of a circular window, forming a lattice work of cast iron, the outer rim of which is of the diameter of the runner; it has a small inner circle forming an eye, through which the spindle passes. A third circle, intermediate between the rim and the eye, but nearest to the latter, is also used; bars radiating from the centre, in the manner of spokes, join these several rims together, and serve as stops for the bark, against which the knives cut.

A tub, which forms the hopper, surrounds the whole; there are radiating partitions in this tub, corresponding with the bars of the bar circle, and these may be considered as a series of hoppers, which, in the drawing, amount to twelve in number.

The operation of the machine will be readily understood. There is no claim made, the whole arrangement probably being considered as specifically different from the cutting and grinding machines heretofore made.

29. For an improvement in the *Head Blocks of Saw Mills;* John Sinclair, Richland, Belmont county, Ohio, February 28. (See specification.)

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30. For an improvement in the *Plough;* Samuel Ogle, Fredericktown, Frederick county, Maryland. Patent issued to his assignee Samuel Witherow, Gettysburg, Adams county, Pennsylvania, February 28.

This is said to be an improvement on the plough for which a patent was granted to said Ogle on the 9th of June, 1818. This patent was for using an iron landside with the cast iron mouldboard, which was cast separately, but attached to the mouldboard by screws, or otherwise. The improvement now claimed is the casting of the landside of greater height than formerly, at its fore part, so that it may reach, or enter into, the beam. This part is to be made sharp, to answer as a substitute for the common coulter.

There is a good drawing of the plough, but no written references, as required by law. Cast iron landsides are described in several patents; some in one piece with the mouldboard, and others attached by screws. The claimants, direct and indirect, to cast iron mouldboards and landsides are so numerous, that should the whole of them become entangled in litigation, their ploughs would prepare a fine harvest for the lawyers, whatever might be the case with the farmer.

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31. For a *Windlass* for hoisting and lowering heavy weights, which the patentee denominates a "Winch and Gin; Ebenezer Allen, city of New York, February 29.

That this windlass is a very good one there is no room whatever to doubt. We cannot, however, go the whole length with the patentee, who avers that "by means of this apparatus, four men can hoist three tons weight; and three men can hoist more in less time than twelve men could do by any other method heretofore used."

We have said that this is a good machine, but those who have arrived at years of discretion have lived to little purpose if they have not learned that goodness and novelty are very distinct things; and indeed that whilst the latter lasts, the existence of the former may be too readily admitted. This machine, however, will not, in our opinion, be liable to any suspicion in consequence of its novelty; for under various forms, combinations, and modifications, it has had the test of long experience, and has fairly won its honours. This *winch and gin*, or *portable winch*, is in form and substance the common hoisting windlass, used for raising stones and other heavy bodies. A square frame is made which is the bed, or ground sill, of the machine; and from opposite sides of this, two uprights rise which are to support the axles, drums, or barrels, with the necessary wheels and pinions upon them, the gudgeons of which run in bearings in these uprights. In raising goods, a winch attached to the upper drum or barrel, is to be turned, and a pinion upon this takes into a wheel on the end of a second drum or barrel; to either of these a rope or chain may be ap-

plied for attaching the goods, and if still greater power is wanted, another barrel, and an extra wheel and pinion, may be employed.

When the goods are to be lowered, this is to be done with the common brake, an instrument known to every competent mechanist. This brake the patentee calls *a spring or friction band*, and describes it as a hoop of iron passing loosely round a cast iron wheel, and capable of being made to press forcibly thereon by means of a lever. When the machine is to be used for articles of enormous weight, a second brake is to be fixed upon another barrel.

We almost fear to copy the final averment and claim of the patentee, as where there are antipodes there must be a whole world between them. He says "this machine, and all its parts, and every method of using it as hereinbefore described, the subscriber and inventor claims as his invention, and he has had the satisfaction of seeing it practically tested and approved on board of many vessels sailing out of the ports of the United States, he accordingly hereunto subscribes his name."

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improvement in the head blocks of saw mills. Granted to JOHN SINCLAIR, *Richland, Belmont county, Ohio, February* 28, 1832.

To all whom it may concern, be it known, that I, John Sinclair, of Richland, in the county of Belmont, and state of Ohio, have made certain improvements in the head blocks of the ordinary saw mill, by which the log to be sawed is held, shifted, and gauged, and the boards delivered in a more advantageous way than has been hitherto done; and that the following is a full and exact description of my said invention, reference being had to a drawing deposited in the patent office, and making part of this specification.

The apparatus which I employ is to be fixed upon each of the head blocks, to hold and adjust each end of the log to be sawed; the description of that upon one, therefore, will serve equally well for the other.

The log is to be held down by a lever pressing upon its upper side, the long end of the lever projecting out behind the head blocks, and its short end holding the log. There is a plate, generally of iron, fixed upon the head block to serve as a support to the fulcrum of the lever, and as a ratchet to retain a pall by which the lever is held in its place. This plate is fastened to the head block, by screws, or otherwise; its plane is parallel to that of the saw, and it may stand about an inch from the centre of the block. Its height will be regulated by the height of the largest log to be sawed.

Near the inner edge, the plate is perforated with holes one above the other, through which the pin, serving as a fulcrum to the lever, is to pass, these holes allow the lever to be shifted to suit the height of the log. The lever has a long slot, or mortise, to admit the plate to

pass through it. The outer edge of the plate is notched in the manner of saw teeth, and forms the ratchet, before named. A pall, or catch, attached to the lever, falls into these notches. When the long end of the lever is raised, its short end holds the log firmly, the pall sustaining it in its place.

To gauge the thickness of the stuff, and also to keep the log in its vertical position, its face, after being slabbed, is forced up against two vertical cheeks, standing at such distance from the saw as the thickness of the stuff may require. These cheeks are fixed upon pieces which slide upon the head blocks, to admit of their being removed to any distance required. I usually fix them to fall back exactly in the manner of the dog which works on hinges, or joints, but in some cases this is unnecessary.

The log, as the boards are cut off, is to be forced up against these faces, and held there by means of a progressive, or travelling lever, contrived for that purpose. A bar of iron is to be bent in the middle, staple fashion, so that the two parts of the bar shall stand parallel to each other, and allow a space, say of one inch, more or less, between them. This, when bent, may be a little longer than half the length of the head block, but must be short enough to pass within the saw frame. Instead of one bar bent, it may consist of two bars, properly secured, so as to answer the same purpose. It is to be fixed upon the head block, one of the bars lying thereon and being secured thereto; its two ends butt against, or may be rivetted to, the plate which supports the first named lever. In the slot between these two bars the progressive or travelling lever works, generally about six inches above the bed of the log. The upper edge of the lower bar is notched to act as a ratchet into which the catches of the progressive lever are to fall. This last lever passes between the two bars; it is furnished with two palls or catches, which fall successively into the notches upon the bar, and cause it, when worked, to follow the log, its short or inner end bearing against the side thereof. The mode in which this is effected will be rendered obvious by the drawing before referred to.

As the boards are to be sawed completely off, the log will become too light to hold the moveable head block down, it is secured, therefore, to the carriage by bolts which pass through it, hook under the carriage, and tighten on the top, by a nut, or otherwise.

Where the situation of the mill admits of it, the boards are allowed to drop through, under the mill, as they are sawed off, a notch being cut into the stationary head block for that purpose; in this case a thin sliding bolt may pass through the block to support the board whilst being cut. When the board is not to fall through, the hinged braces, which have the cheeks on, are thrown back, the board then falls, and is removed.

What I claim as my invention in the before described machinery, is the manner in which the log is held in its place by means of the levers which press upon its upper side, acting upon the principle herein described; the manner in which the boards are gauged by forcing the log against the vertical cheeks before described; the construction of the progressive, or travelling, lever, which forces the log

up without the aid of a crow bar, or other usual means; and the plan for allowing the boards to fall through the head block.

ENGLISH PATENTS.

To J. De Burgh, *Marquis of Clanricarde, a patent for improvements in Fire Arms, and in the projectiles to be used therewith, was granted on the* 15*th of July,* 1831, *and the specification was enrolled on the* 14*th of January,* 1832.

The improvements above mentioned consist in a moveable receptacle termed a sliding breech, into which the charge or projectile is immediately put, instead of loading in the usual way at the muzzle of the fire arm; and in the employment of a solid cylinder of lead divided into several pieces instead of spherical bullets.

In the specification is given an example of the application of these improvements to a large kind of pistol. The handle, cock, and other mechanical movements employed to ignite the charge, are much the same as in other fire arms; the barrel is provided at its breech end with trunnions, which enter apertures made into two strong iron plates fixed on the sides of the stock of the pistol; and a cavity is left between the two plates next to the end of the barrel for the reception of the sliding breech, which is internally made cylindrical for receiving the charge, and externally adapted to fit into its recess; it has a touch hole and tube for the application of a percussion cap, and turns upon an axis at one end into an inclined position, and by a motion of the hand, similar to that of half cocking a common gun; the charge being now inserted, and the breech shut down, its orifice is brought to bear in an exact line with the interior end of the barrel. In order that these parts may be accurately and firmly connected, the exterior edge of the orifice of the breech, and the interior edge of the orifice of the barrel, are turned to cones of similar inclinations so as to fit concentrically; and they are brought into close contact by a transverse wedge situated at the back of the breech, which by the action of a simple lever of great mechanical energy, moved by the thumb and fore finger of the right hand, (somewhat similar to that used in shutting down the pan of a common fire-lock,) forces the breech into the end of the barrel, and thus prepares the arm for being discharged. The sliding motion of the breech is only through the space of from a quarter to three-eighths of an inch; and it is guided laterally by the side plates—above, by an overlapping plate—and below it is confined by a fixed screw which works through an aperture adapted to it. The wedge, therefore, causes the breech to slide and lock all fast; and to reload, the lever of the wedge is thrown back by the right hand, and the fore finger of the left hand then laying hold of a kind of trigger, draws the breech out of the barrel, when the

former is again turned up, and recharged with the projectile; which projectile is of the following description.

A solid cylinder of lead, about two and a half times the length of its diameter, is divided longitudinally by two cuts at right angles to each other, through its axis; and again by two other cuts transversely at equal distances from each other and from the extremities of the cylinder; thus producing twelve equal and similarly formed pieces, except that at one end of the cylinder a hole is made in the centre to receive some percussion powder. As the cutting of these pieces out of a solid cylinder of lead is attended with some difficulty, the patentee has constructed a mould for casting them of these forms. This mould is a tool consisting of three limbs or bars sliding over each other by being connected at one end to a common joint or centre. The cavities or moulds in each of these bars are short cylinders divided longitudinally as before mentioned by thin metallic partitions; so that by a tool of this kind the twelve separate pieces of the projectile are easily cast and cut off. This combination of pieces is then wrapped in paper with the requisite quantity of powder at one end to form the cartridge, which is made of suitable dimensions to fit the chamber of the sliding breech described. We should now state that the barrel of the pistol (or other arm) is made gradually to widen, laterally from the breech to the muzzle, where it assumes the form of an extremely long ellipsis, (its transverse axis being about three times that of the conjugate,) which will cause the pieces of lead to separate and spread laterally, so as to wound or destroy a great number of persons.

[*Reg. of Arts.*

To JEAN JACQUES JAQUIER *a patent for improvements in machinery for making paper, communicated to him by a foreigner, which he denominates Xeranothlipte, was granted on the* 31*st of August,* 1831, *and the specification was deposited on the* 29*th of February,* 1832.

M. JAQUIER prefaces the description of his machinery by stating, that in all the apparatus previously constructed for making machine, or endless paper, with the great wire lines, similar to those in laid paper (or that made in hand moulds,) the pressure given to the pulp to consolidate it, had the effect of cutting the paper through, or into ribands of the width of the spaces between the lines. With the view of obviating such a serious defect in this imitation of laid paper, M. Jaquier conducts the sheet of fresh pulp on the endless wire web over an extended series of horizontal rollers, whence it passes round the main cylinder without receiving any pressure; but during its extended journey to the main cylinder, it has acquired sufficient consolidation by constant drainage and the shaking of the machine, to be capable of bearing afterwards a slight degree of elastic pressure, which

is produced by a small roller under the main cylinder; this roller is covered with several folds of "nappy cloth," partly to prevent its taking the paper off the mould, and partly to confer elasticity and a greater uniformity of pressure against the wires and the intervening paper. The operation of this roller so situated, gives the continuous sheet of paper sufficient strength and tenacity to allow it to be taken off the wire web, which is immediately done by the paper on the wire web being brought into contact with a roller carrying an endless felt of open cloth, to which the paper adheres in preference to the wire work mould. It is then carried forward by the endless felt, when the paper is made to bear against another series of rollers carrying another endless felt: the paper is thus pressed and drained between two cloths, before it is carried between the ordinary pressing rollers, whence it is delivered sufficiently manufactured to pass between the drying cylinders.

This invention appears to be of some practical value, and we should have given a drawing of it, had it not been so negligently and incorrectly specified as to render some parts unintelligible.

The claim relates to the mode of giving pressure to the paper after it has passed under the main cylinder, and to the subsequent pressure between two endless felts. [*Ib.*

To W. MASON *a patent for improvements in the construction of wheel carriages, was granted on the* 10*th of August,* 1831, *and the specification was enrolled on the* 10*th of February,* 1832.

THE intention of this patent is to afford the means of turning four-wheeled carriages without diminishing the size of the fore wheels, or cutting recesses into the frame work or body of the carriage for the reception of the wheels in the act of turning. This important object is proposed to be obtained by means of joints in the fore axle-tree, between the carriage frame and the naves, to allow the ends of the axle-tree to move horizontally backwards and forwards without altering the position of the middle portion, which remains eminently right across the carriage. At each of the joints, and connected with the portions of the axletrees which fit into the naves, is fixed a bar which connects the wheels with the splinter bar, to which it is jointed, so that the middle portion of the axle, the splinter bar, and these two side bars, form a parallelogram, which remains rectangular only, while the carriage is proceeding straight forwards. The pole of the carriage is likewise jointed to the middle of the axle and to the middle of the splinter bar, by which means any change in the position of the pole to the right or left will cause a corresponding change in the position of the levers constituting the before mentioned parallelogram, and consequently prepare the wheels for turning.

We have not deemed it necessary to enter upon the minute details by which the patentee shows in his specification, the proportions of the various parts of his arrangement, so as to afford the re-

quisite strength to an axle with vertical joints, as what we have stated will be quite sufficient to give the reader a general idea of the principle and application of the invention. [*Ib.*

To HENRY HOPE WERNINCK *a patent for improvements in apparatus or methods of preserving lives of persons and property when in danger by shipwreck, by speedily converting boats or small vessels of ordinary description into life boats, and other apparatus or means applicable to the same objects, was granted on the* 24*th of September,* 1831, *and the specification was lodged on the* 24*th of March,* 1832.

THIS invention, which is said to be the communication of a foreigner residing abroad, consists in various methods of making and applying buoyant apparatus. The patentee first describes the method of manufacturing a buoyant balloon, made of a series of fifty or a hundred bullocks' bladders, which are to be cleaned and prepared by removing carefully the necks, and portions of fat which may be left adhering to them, turning them, and oiling well with linseed oil on both sides, then filling them with air, and securing well the aperture through which they have been filled by the introduction of a short wooden pipe, and a well fitted plug. The bladders are then to be attached to a hoop of an appropriate size, according to the weight which they are intended to carry ashore. Over this hoop and these bladders is placed an egg-shaped canvas bag, preserved in its distended form by means of a light cane basket. A bladder is also used, after having been prepared as above, for conveying a letter from a ship in distress to the shore. In this case the wooden pipe which is inserted into the neck of the bladder, is made sufficiently large to admit a letter rolled up. The aperture is then securely plugged up, and the apparatus committed to the water, on which it will float with a velocity nearly equal to that of the wind. This, it is contended, may be frequently the means of conveying to the persons on a lee shore, or to those on board other vessels to the leeward of the one in distress, intelligence in time for relief to be afforded.

Another method of making buoyant apparatus is described in this specification to consist of Dutch or other light rushes, or similar substances cut into appropriate lengths, according to the size and form of the intended apparatus. They are then to be tied securely together, covered with strong brown paper or pasteboard, or both, moistened and pasted so as to prevent the passage of air: after this a covering of bladder is applied, and the parts of which it is composed are securely cemented together; and, lastly, a canvas covering is to be applied, and the whole secured by resinous varnish and coal tar, so as to render the apparatus impervious to water.

Amongst the numerous instances which the patentee furnishes of the application of the buoyant bunches of rushes, are their introduction round the edge, over and under the seats of a common boat, to

convert it into a life-boat, to a man's person in the form of a floating jacket or dress, to render him buoyant in the water; or round his waist, in the form of a large annulus or collar; and lastly, it is proposed that a horse shall be surrounded with a buoyant dress reaching nearly as low as the feet of the rider, so that the animal may be enabled to float on the water, without being at all sensible of either his own weight or that of the rider. [*Ib.*

To WILLIAM BINGHAM, *Esq. and* WILLIAM DUPE, *Gunmaker, a patent for certain improvements on fire arms of different descriptions, was granted on the* 24*th of September,* 1831, *and the specification was deposited on the* 24*th of March,* 1832.

THE introduction of percussion powder instead of flint and steel for igniting gunpowder in fire arms, has given rise to a very great variety of modifications in the construction of gun locks, and amongst others to the one before us, in which it is proposed to make the barrel terminate in an acute conical cavity within the breech, and from the apex of this hollow cone proceeds the touch hole to the priming nipple. The hammer, which is operated upon at once by a straight main spring, strikes the nipple within the stock, so that there appears nothing on the exterior but the handle by which the cocking is effected. The seear and the trigger are likewise much simplified, being but one piece. The whole arrangement is simple and ingenious, and appears well suited to the purpose for which it is designed, though there are many parts of the lock which approach very closely to other patent contrivances having the same object in view.

These patentees propose in addition to the foregoing, a very material alteration, and, we are inclined to think, considerable improvement in the manufacture of the stocks of muskets and other fire arms. They propose to make the whole, or at all events the principal parts of the stock of sheet iron, by which they contend that the cost of manufacture will be diminished, while the stocks will be rendered more useful, particularly when applied to military purposes; and much more durable, as they will, according to the specification, last almost forever. A piece of sheet iron is first cut out of the form of an isosceles triangle, whose central length is about twice its breadth at the base; this then is bent into the required form by means of a saddle backed anvil, or block, and suitable tools. It is then to be cleaned and painted, or japanned inside, to prevent it from rusting; then to be securely fixed to the fore part of the stock, which may be either made of iron or of wood, in the usual manner, according to the purposes for which it is intended; the preference is, however, given to iron. The butt end and the top are to be inclosed by soldering in plates made to fit the opening, but if the stock be intended for a soldier's musket, the end plate is made to open to admit a soldier's provisions, or ammunition, and thus the utility of the musket will be

augmented. The exterior of these iron stocks is to be bronzed of the usual colour of gun stocks, or of any other, to suit the taste of the manufacturer or his customers. [*Ib.*

To WILLIAM DRAKE, *Tanner, a patent for improvements in tanning hides and skins, was granted on the 7th of October,* 1831, *and the specification was enrolled on the 7th of April,* 1832.

THE principal novelty in this patent consists in applying the tanning liquor on one side only of the skin, and causing it to ooze through the skin to the other side; from whence the aqueous portion of the liquor is chiefly abstracted by evaporation. The result of this process is said to be, that the skins are more thoroughly and uniformly tanned, and the operation is completed with *cold* liquor in ten *days* instead of ten *months*. If this statement should prove to be true, and we see no good reason to doubt it, the patent is one of great value and importance.

The specification informs us that the skins or hides to be tanned are to undergo the usual primary process of *liming;* they are then to be immersed and well *handled* in a vessel containing *backward*, (which is a weak solution of tan,) until thoroughly saturated, which removes the lime and prepares them for a stronger impregnation. Thus prepared, the skins, excepting such as are intended for *butts* and *middlings*, which are shaped accordingly, are to be rounded (i.e. their irregular edges taken off,) then two of them are to be laid together face to face, and be carefully sown together with waxed thread at their edges, so as to form a kind of bag impervious at the junction, leaving a small opening at the shoulder for the insertion of the neck or spout of a funnel shaped vessel; but, it is to be observed, it would be preferable to sew between the skins a collar adapted to receive the end of the funnel. As bags so formed would bulge out when filled, they are to be confined between two-gridiron-like frames of parallel bars adapted to compress the bag in such a manner as to produce internally a vertical stratum of liquid of about an inch between the two skins; and as the skins are thickest towards their middles this variation is compensated for, by cutting away a portion of the vertical wooden bars from a straight into a hollow curved line. The skins are suspended by loops to the bags, which traverse the upper horizontal bars of the frames, and the two frames are duly drawn together by four screw bolts passing through the extremities of the top and bottom bars. The funnel being inserted into the aperture between the skins, it is charged with strong tan liquor sufficient to distend the bag and leave a surplus quantity to supply the loss by evaporation after the moisture has penetrated to the outside of the bags; a small gutter at the bottom of, and between the frames, receive whatever liquid may drop from the skins, and conduct it into a vessel, by which it is returned whenever necessary into the funnel reservoir above. To prevent the compression of the vertical bars from form-

ing permanent indentations and ridges in the skins, the patentee directs that the bags be occasionally shifted a little laterally.

To facilitate the evaporation, and consequently the absorption of fresh solutions of tan, the operations are recommended to be conducted in chambers artificially warmed, and the liquor which oozes through the skins, and is received into the gutters, is directed to be conducted into vessels acting the part of refrigeratories, in order that *cold* liquor may always be supplied to the skins; but how this liquor is to be preserved cold in a warm chamber, the specification omits to inform us.]

When the skins are sufficiently tanned, which is well known by various indications to practitioners in the line, (chiefly, by their increased thickness, hardness, and russet colour,) a stitch or two of the sewing at the bottom of the bag is opened, and the liquor is received and carried off by the gutter underneath.

The claim to invention does not consist in the mere application of liquor inside of a bag formed of skins, but to the general combinations, and especially to the mode of accelerating the penetration of the tanning liquor by exposing the outer sides of the skins to evaporation.

Although we have a very favourable opinion of this process, and that great economy will result from its adoption, there appears to be one defect in it. The skins being laid vertically, the pressure of the column of liquid will cause a much more rapid absorption of the tan in the lower than in the upper part of the skins; and if no injury is produced to the lower by continuing the process until the upper is fully saturated with tan, there is at least a loss of time. It is also probable that the liquor is stronger at bottom than at top of the bag. From both these causes, therefore, we should not expect that the leather produced would be very uniform in its quality. To obviate these defects, we would submit to the patentee, as a preferable arrangement, (and one which will not affect his patent right,) to suspend his frames midway upon axes of rotation, and to fix at each end of his bag a charging vessel with a stop cock, or some other simple contrivance to answer the same object. The bags may then be reversed at pleasure, or placed in any desired position, and the lateral shifting required between the bars will take place of itself. If there were only one charging vessel with a stop to it, it would suffice, as by turning the frame round half way, it may become the discharging aperture. [*Ib.*

To WILLIAM LLOYD WHARTON, *Esq. a patent for certain improvements in engines for raising or forcing water by the pressure and condensation of steam, was granted on the* 30*th of January, and the specification was enrolled on the* 30*th of March,* 1832.

STEAM engines, on the principle introduced by Mr. Savary, are those intended to be improved by Mr. Wharton's invention; but in-

stead of allowing the steam to come into contact with the surface of the water in the cylinder, he interposes between the two a large hollow float, of an exterior diameter very nearly equal to that of the interior of the water and steam cylinder. Over the water in the cylinder is introduced a quantity of oil, which passes up the sides of the float, and prevents the steam from ever coming into contact with the water to be acted upon. After the steam has been admitted from the boiler into the cylinder, and forced down the float, and consequently the water underneath, it is conveyed to a conical condensing vessel considerably elevated above the cylinder, where it is condensed by means of a jet of water admitted from another vessel situated immediately above the condenser. And thus a vacuum is obtained in the upper part of the cylinder, which allows the atmospherical pressure on the surface of the water to send up a quantity sufficient to elevate the float to the top of the cylinder, when the steam is again admitted to force down the float, and through that medium to force the water, now occupying the cylinder, to ascend a delivery pipe to the required elevation. The supply pipe is provided with a valve, opening upwards, to prevent the return of the water into the well, or reservoir, from which it has been raised; and the delivery pipe is also provided with a valve opening upwards, to prevent the return of the water into the cylinder when the vacuum is created.

A tumbler hammer is introduced for the purpose of opening the communication between the steam boiler and the cylinder, and closing the communication between the cylinder and condenser when the float reaches the top of the cylinder, and of reversing the stop cocks, or valves of these communications when the float reaches the bottom of the cylinder, thus rendering the engine self-acting as far as regards the opening and closing of the steam communications.

[*Ib.*

Patent granted to BENJAMIN AINGWORTH, *Button Maker, for an improvement in the making and constructing of Buttons. Dated August* 30, 1831.

THIS patent is for a minute improvement on that of Mr. Aston, of Bromsgrove. It is not that we, with Sylvester Daggerwood, have "a soul above buttons," but we find it extremely difficult to understand the exact degree of improvement to which the patentee lays claim. We had no idea that the mystery of button making was so abstruse. It appears from the evidence of Mr. Aingworth that a button could never be made at all, if it had its own way, and was not absolutely compelled to be a button. Animals are tenacious of life, but buttons show a yet more remarkable tenacity of nonentity. Would the reader believe it? Three plans are appended to this most voluminous patent, which occupies as much parchment as would make a million of buttons, and that these three plans represent an army of figures and a myriad of means to compel the reluctant elements of a button to cohere and become a button! First, a piece of cloth of a peculiar

texture, is cut out larger than the size of the intended button; then two or three, or more pieces of thick paper; then a metal plate; then a bevilled steel ring; then *encore du papier;* and, "conclude with the cloth," as they say in quadrille dancing. So much for the materials, in which there is little new but the paper. These are divided into two portions; the former cloth, paper and steel, are put into a barrel, or rammer, or tube fitted into a bench, or frame, or,—may we name it?—a shop-board. In this tube, by means of a plug, the materials are pressed together. A similar barrel receives the other portions of cloth, steel, and paper, which are in like manner compressed. The two tubes are then united, and the whole of the component parts of the buttons are pressed together so as to form *one.* The edges of the cloth and paper are turned round the bevilled ring, and being then removed to a very pretty instrument of the press kind, the button receives its last squeeze, and comes out completed.

After all these perils, the button is supposed to be superior to any button that has suffered less. It can be stitched to the coat without an elastic neck; it sits more closely, and its soft edge does not wear the cloth as a metal one would do, (the ring, or plate, being wholly covered by the edges of the softer materials,) and Mr. Aingworth thinks that he has achieved much in making a button without a neck. We have no doubt that the improvement is great, but we cannot understand it. The more kinds of buttons the better; the more machines, the better; the more hands employed, the better; and the more patents the better, say we. We heartily wish that better times may come soon, that men may wear more buttons to their coats, and more coats to their buttons than the present times will afford.

[*Rep. Pat. Inv.*

¶ Royal Ordinances of France relating to Steam-Boats.

(Translated for this Journal.*)

Circular of 1st June, 1830, to the Prefects of Departments in relation to the instructions appended to the Ordinances of 2nd April, 1823, and 15th May, 1828.

Sir,—You have received the circular of the 1st of August, 1828, relating to steam-boats and to the boilers of the steam engines used in those boats.†

At the end of this circular will be found the two ordinances of 2nd April, 1823, (Bulletin of Laws, No. 601, p. 306,) and 15th of May, 1828, (Bulletin of Laws, No. 233, p. 497.)

You have doubtless attended to the formation of the committees of superintendence, to be appointed by the Prefects, (according to

* We observe that the translations of former ordinances made for this Journal have been transferred, *without acknowledgment,* to the pages of the Register of Arts, and Journal of Patent Inventions, (London.)—Trans.

† See the translation in this Journal vol. vii. p. 272, 323, 399, and vol. viii. p. 32.

article 1st of the ordinance of 2nd April, 1823,) of the Departments in which there are rivers, or which are upon the sea-board, and where steam-boats are or may be established. These committees have very important duties to fulfil, in which the prosperity of commerce, as well as human life, is interested.

The ordinance of 2nd April, 1823, has left to the authorities the task of completing the details of the system.

I have published a special instruction, in order to facilitate the execution of the ordinances concerning steam navigation; and to establish, as far as is possible, uniformity in the local regulations which it is the duty of the prefects to draw up. It has been prepared after mature consideration by the committee of engineers of mines, and of civil engineers, (organized in 1823,) which have charge of all questions relating to the steam engine.

This instruction contains, in addition, explanations respecting the internal police of steam-boats.

You will find copies of it enclosed.

The instruction contains the provisions of the ordinances and directs the mode of executing them. There is an express prohibition against proving by the hydraulic press, (and consequently against stamping,) any boiler terminated by plane ends, which thus differs in form from the proper high pressure boiler.* These boilers, with plane ends, could not be proved without being put out of shape; they are only worked at very low pressures, and are not dangerous when provided with safety valves loaded directly, with fusible plates, and with an open steam gauge.

The instruction is divided into seven paragraphs, relating,

1st. To the superintendence and management of the engine.

2nd. To the feeding of the boiler.

3d. To the safety valves.

4th. To the fusible metallic plates.

5th. To the gauge.

6th. To the management of the fire.

7th. To the internal police of steam boats.

By the first of these paragraphs, it is made essential to the permit of navigation that there be placed on board of every boat intended for the convenience of passengers, an engineer whose *sole* business it shall be to superintend the engine. Great good is expected to result from this measure.

At the end of this instruction is placed a new table of the elastic force of steam corresponding to different temperatures. This table is the result of the labours of a committee of the Royal Academy of Sciences; their perseverance, courage, and ability, merits the highest eulogies. This table, (referred to in the circular of the 19th of May, 1825,) is to take the place of the table contained in the instruction of the 7th of the same month, provisionally reported by the academy.

* This is a most singular prejudice, since the ends can be indefinitely strengthened to meet the strain upon them. It would entirely exclude from use the American high pressure boiler.—Trans.

I beg you, sir, to pay the strictest attention to the contents of the present instruction, and to enjoin the most attentive observance of its provisions on the various local authorities charged with assisting you, and particularly on the committees of superintendence in your department.

I request that you will send copies of it to each member of the committee, to the engineers of mines, to the government civil engineers, to the custom house officers, mayors and adjuncts, to the commissaries of police, to the commissioned and non-commissioned officers of gendarmerie of the cities and communes situated on the lines of navigation, as well as to the proprietors of steam-boats.

In acknowledging the receipt of the present, you will oblige me by sending the names of the members of the committees of superintendence in your departments. I desire further that you will report any changes which may take place in them.

I have the honour to be, &c.

(Signed,) CAPELLE,

Minister of Public Works.

Instructions relating to the execution of the Royal Ordinances concerning Steam-boats. To govern in preparing Regulations for the Departments.

Steam-boat navigation is regulated by the royal ordinances of the 2nd of April and 29th of October, 1823, 25th of May, 1828, and 25th of March, 1830.

By the first of these it is ordered that in the departments where there are rivers or coasts upon which steam-boats are, or may be established, committees of superintendence appointed by the Prefect must satisfy themselves that the engines and boats have due strength.

No steam-boat can have a permit of navigation, until the committee charged with its examination has proved its strength, and the good condition of its engine, and until the Prefect has notified the proprietor that he has received and approves the report of the committee. This notification should always be accompanied by a statement of the regulations which the Prefect may see fit to prescribe to the proprietor of the boat in relation to the general concerns of navigation. Lastly, formal visits of inspection, (and others,) must be made as often as is necessary by the committees, who must give, in their report addressed to the Prefect, their suggestions as to the measures to be taken in case the condition of the engine should require attention.

The regulations of the second ordinance, that of the 29th October, 1823, chiefly concern high pressure engines. A system of precautions is established, which, however, is well known, and has been applied for a long time to high pressure engines used in navigation; excepting, however, so much of the regulations as relates to the

guard walls and to the space around the boiler, it being impossible that such arrangements should be made on board of boats.

The third ordinance, that of the 25th of May, 1828, contains among other provisions one by which the measures of safety prescribed by articles 2, 3, 4, 5, and the first paragraph of article 7th of the ordinance of 29th October, 1823, and also by the ordinance of 7th of May, 1828, are extended to the boilers, boiler tubes, cylinders, and jackets of cylinders of low pressure steam engines used in boats.

The fourth ordinance, that of 25th of March, 1830, concerns steamboats in part, since it relates to low pressure engines in general. By this it is ordained that the safety valves of low pressure engines used in navigation, shall be loaded directly, and that every engine shall be provided with an open gauge, the length of which is to be determined according to the working pressure of the steam in the boiler.

It will not be difficult to regulate both low and high pressure engines of steam-boats in conformity to the different measures of safety prescribed by the ordinance just stated, if attention be paid to the instructions of 19th of May, 1824, 7th May, 1825, and 12th July, 1828, (which relate to high pressure engines in general,) and to the provisions now to be explained.

The stamps, formerly described, to be used for marking the results of the proof of a boiler, will be struck off at the mint at Paris, and inscribed with the words, *Ordinance of 29th of October*, 1823. It has not been considered worth while to sink new dies for the ordinances of the 7th and 25th of May, 1828, as these are only a continuation of those of 29th of October, 1823.

The degree of fusibility necessary to be given in each particular case to the metallic plates, has been heretofore calculated by means of a table constructed provisionally and published by the government at the end of the instruction of the 7th May, 1825. Since then a set of experiments has been made by the Royal Academy of Sciences to determine, with precision, the elastic force of steam at different temperatures. The result of these labours will be found in the exact and extensive table inserted at the end of this instruction, and hereafter to be used instead of the provisional table.

The makers and proprietors of steam-boat boilers are informed that they can always procure, as heretofore, at the manufactory of M. Collardeau, not only fusible metallic plates, for all required temperatures, but also fusible metal in bars. But it is necessary at the same time to state to them that it is difficult, without practice, to obtain, from the metal in bars, plates which shall fuse at the same degree precisely as the bar itself; it will be much safer for them to make use of plates which have been cast at the manufactory, as these are carefully tested after being made.

The fusible plates should be at least five-eighths of an inch thick, and should be covered on the outside with a cast iron grating to prevent them from swelling out when they are heated near to their fusing point. But in using these gratings it is necessary to increase the diameters fixed by article 5th of the royal ordinance of 29th Oc-

tober, 1823. This increase of size should be such as to make the free surface of the more fusible plate equal to the surface of one of the safety valves, and the free surface of the less fusible plate quadruple that of the surface of the same safety valve. Manufacturers and owners of boilers can obtain at the above mentioned manufactory gratings prepared for plates of all sizes, and so arranged that they can easily be fixed to the boiler and removed from it.

The use, on board of steam-boats, of boilers, and boiler tubes, of cast iron, having been prohibited by the ordinance of 25th of May, 1828, the boilers and boiler tubes of wrought iron, or sheet copper, used on such boats must be proved, (according to the terms of that ordinance and the one of 7th of May, 1828,) under a pressure triple of their ordinary working pressure.

No boiler which is terminated by plane ends, and therefore differs entirely in its form and arrangement from the proper high pressure boiler, shall be subjected to this proof, consequently none such shall be stamped.

Boilers with plane ends could not be subjected to the prescribed proofs, without being put out of shape by them; the proof by the hydraulic press is in this case so much the less necessary, as such boilers are seldom used under high pressures. These boilers work at very low pressures, rising at the highest to an atmosphere and a half.

While such boilers are exempted from the proof by the hydraulic press, their use is absolutely prohibited for pressures exceeding an atmosphere and a half. When used their safety valves must be loaded directly with a weight equivalent at most to half an atmosphere, that is to say, with a weight of seven and a half pounds for every square inch. Further, fusible plates corresponding to the temperature of steam of the pressure of an atmosphere and a half must be adapted to the upper part of the boiler; the first of these plates, i. e. the smaller, should fuse at 251½° Fah.,* and the second, the larger, at 269½° Fah.†

The cylinders, and jackets, of engines having boilers with plane ends are by no means exempted from the proofs, which, in this case, must be applied as usual, and the cylinders and jackets shall then be stamped an atmosphere and a half.

If it be necessary to adhere strictly to all the prescribed precautions in the management of stationary engines, even more attention should be given to those of steam-boats. In such cases recourse cannot be had to walls, &c. to ward off the effects of explosion, and when accident occurs the lives of a great number of persons are necessarily jeoparded. The local authorities cannot, therefore, exercise too much activity and foresight in the use of the powers which have been confided to them in respect to steam navigation.

Too much care cannot be taken, particularly by the committee of superintendence, in conducting the examination which must precede every permit of navigation. In their report they must give an exact account of the state in which they have found the principal parts of the engine of every boat. They ought especially to satisfy themselves

* 122° Centigrade. † 132° Centigrade.

that the arrangement of the fire cannot give rise to any accidents, that the play of the pump for supplying the boiler is sufficiently great, and that the working power of the engine is sufficient to overcome all the obstacles of the projected navigation.

The royal ordinance of 2nd of April, 1823, has given to the local authorities of each department, the power of filling up the details of the general system of precaution. The authorities should hasten to use the power entrusted to them; many prefects have already done so with success. As it is material, however, that there should be as much uniformity as possible in all provisions of this nature, we now bring into view the principal points to which attention should be paid in drawing up such regulations.

[TO BE CONTINUED.]

¶ On Working Iron and Steel.*

The thanks of the Society were presented to C. Varley, Esq. for the following paper.

The society having favourably received the description of my late uncle's method of condensing brass, in which I endeavoured to show the conditions which are requisite for the *extreme* and *uniform condensation* of metal previously sound; and knowing of how much consequence it would be to secure the soundness of anchors, iron tires, girders, and other implements, to which the safety of human life and property are so often trusted, I am encouraged to pursue the subject, and to endeavour to show the means by which iron or steel may be rendered sound, and preserved so while working, and even during welding. But on a subject supposed to be so well known, and in which I must repeat much that is known, for the sake of connexion, it may be well to justify myself by showing, in the first place, how inadequate the ordinary practice is to prevent unsoundness.

Iron.

The welding of numerous layers of good iron together, so as to form one bar, is considered to render it much tougher and more trustworthy than if it had been wrought out of one piece; for it breaks joint with, and equally mixes the strong and weak parts. But many stop here, believing they have done all they can; yet every welding may be discovered which proves that a considerable degree of unsoundness accompanies this process.

If we notice the pump handles about town which are constantly exposed to the weather, some are found where the continual wear from handling exceeds that of the weather: these acquire nearly the best polish that soft iron is capable of. But there are many in which the wear from handling barely keeps pace with the decomposition by weather; in these, the last weldings which united the different parts

* From the Transactions of the Society for the encouragement of Arts, Manufactures and Commerce.

together to form the handle are most distinctly marked, and the various layers of which the mass has probably at different times been formed may be seen, very much resembling the longitudinal grain of wood. Here is sufficient proof of the want of homogeneity; and, seeing it is a constant attendant on welded iron, we are led to inquire what causes the necessity for welding. The answer is, first, the acknowledgment that iron is liable to invisible unsoundnesses, and that by welding they are likely to be distributed among sound parts and thereby equalize the strength of the mass; secondly, that there is a certain thickness beyond which the most governable hammers fail to produce the full effect of condensing the iron all through; and this thickness being far short of that required for anchors and other implements in which the utmost soundness and strength are wanted, such can only be made up by welding. Within that thickness there is no direct necessity for welding; but beyond it we have no means of rendering the whole mass sound. This necessity of sometimes having recourse to welding renders it of consequence to know what there is in the process of welding that makes the laminæ visible.

When newly reduced iron is hammered till it becomes quite malleable and well closed or united, it may be considered homogeneous and sound, from its having no weldings and no carbon, this latter being carried off by the oxygen of the bar, and the beating. Whatever oxygen the surface imbibes in after heatings is beaten off in scales while giving the required shape to the bar. It therefore remains as sound and free from oxygen as before; for oxide of iron is not only brittle, but incapable of uniting by welding with malleable iron.

But when two such masses or bars are heated for welding, they become again coated with oxide; and then, when laid one upon the other and submitted to the action of the hammer, the oxide is shut in, and union of the bars can only take place in proportion as the two plates of oxide are broken up and the subjacent malleable particles are brought into mutual contact.

From this intermixture of oxide and metal arises a spongy texture (more easily acted on by the air than the pure solid metal,) which distinguishes the welding from the rest of the mass. If, therefore, several layers of good iron were welded together and beaten very much out without hammering the edges, on filing these square and cleaning the four sides, a little weak acid would soon distinguish the edges of the layers from their flat sides, and they might probably be counted.

But in ordinary practice iron is never left so: it is beaten in all directions, to give or keep the required shape, which so bends and distorts the layers that they are liable to be found in all directions; yet the lamellar structure remains, however much broken, and when obtained in a suitable degree, contributes to give that ornamental surface called *damask;* and as all much elongated iron, such as nails, wire, &c. show a fibrous texture when acted on by weak acids, this intermixture of oxide may cause variation in that texture.

Now the evils which arise from oxidizing the surface increase with the size of the weldings; for the great length of time the surfaces of large masses must be exposed to an urgent fire to obtain the welding

heat, will cause so deep an oxidation that the union will be so much the more difficult to effect; for there needs a proportionate increase of hammering to break through a thicker coat of oxide, while the difficulty is increased of transmitting the force of the hammer through larger masses to the welding surfaces; so that the union is liable to be as much less perfect as the mass is greater.

Accordingly, as it is very common to meet with anvils whose large beak, and sometimes other parts, are broken off at their weldings, showing how very imperfect the union was, and that only at the edges, and seldom any at the centre.

And as an acknowledgment, by a workman, of the general deficiency of weldings, the society, in 1820, rewarded Mr. R. King for his method of avoiding them, by forging the anvil top, its beak, and opposite overhanging, in one piece, the base in another, and then welding the one on the other; so that in use this welding is the least exposed to strain.

Again: We frequently meet with iron wire that will strip in two like splitting a twig, and sheet iron that will split or peel up in parts; all showing either the inability of producing complete union or of knowing when it is effected.

I have thus far traced the unsoundness which accompanies welding: next I shall show what takes place when the weldings are quite sound; and shall pursue it, if possible, to the obliteration of every sign of previous welding.

If we recur to the melted carburet of iron, which is puddled or brought to a pasty state, and then hammered at a great heat till it has lost all its carbon, and till every part of the metal has united in one mass and become malleable, and observe what takes place during the process, we shall obtain a tolerably good hint for welding. The iron is still considerably divided by an excess of carbon, and probably by other impurities not easy to be defined. These are fast oozing out, and the carbon is burning at the surface, while the hammer is continually bringing portions of the iron into closer contact, so that they unite; and the pure metal being much stronger and tougher than the crude, it will keep together and combine with every particle of sound metal with which it comes in contact while the crudities are exuding; and this goes on, to the improvement of the quality, so long as any carbon remains; for, during that time, perfect welding must go on, because the carbon takes the oxygen and leaves the surfaces pure or clean for union. Thus the iron becomes one solid mass free from oxygen; for oxygen and carbon mutually take each other away in the form of gas, and leave the iron pure. Now, if ever so much hammered after this, the iron may proceed to perfect soundness and homogeneity; but it will be at the expense of the surface, which is detached in scales as it passes to the state of oxide, in which state, as I have before observed, it is incapable of uniting with metallic iron.

The conversion, however, of crude into malleable iron is never perfect till the mass is so reduced in thickness that the welding force of the hammer is felt all through; and then if all the oxygen is re-

moved from within, it may be obtained quite free from flaws (at least all but minute ones,) and is fit for use.

Having thus established some thickness up to which, with given tools, new iron may be obtained sound, we begin to increase that size by welding; and here begins a new and very different cause for unsoundness, which will require our farther notice.

Various means have been resorted to in order to protect the surfaces of iron from oxidation while in the fire, such as sand, glass, salt, or any thing that will bear the fire; but these require to be scraped off before the bars are put together for union. Now, any portion of such matter that is not removed is itself a cause of unsoundness, and when perfectly removed, a thin coat of oxide forms on the clean surfaces and is shut in.

In order to obviate this latter evil, the iron should be coated with carbon, as though it was to be case-hardened, by immersing or laying it on a bed of carbonaceous matter, kept very hot till it has imbibed enough to engage all the oxygen that would otherwise attack it during welding: moreover, this carbon blazing out at the surfaces, helps to keep up the heat till they completely meet together. The surfaces ought also to be slightly convex, that welding may begin at the middle (that part being liable to receive less impression from the hammer,) and proceed gradually to the edges: thus the blisters that are liable to be produced from the union of oxygen and carbon are more likely to be beaten out. And more particularly as the masses singly were as thick as the hammer can govern, and now being doubled, its effect is lessened at the welding surfaces, therefore more care is required in the mode of bringing them together; for unless each part is kneaded together enough to adhere before the heat lowers, some parts will only be beaten close without union; and all after heatings affect the outside more than the joint. Also, if any air is shut in, this likewise retards the union; but a convex surface gives the best opportunity for it to escape.

Next, supposing the iron protected as usual, if, at the moment the substance used for this purpose is well scraped off, the surface is sprinkled with good cast iron, or still better with cast steel filings, this addition will introduce carbon enough to engage the oxygen, and a sound welding may be expected. Here the operation is similar to the original reduction of the iron to the malleable state; for perfectly clean iron unites very readily if brought into close contact at a suitable heat.

This process for uniting iron which otherwise was too thin for welding has lately become public, and by some has been called soldering, under the notion that the cast iron melted between the surfaces.

Iron is too thin for welding if it cannot retain the heat long enough under the hammer (or when the remaining good metal is not enough to squeeze through, or mix up with the oxide) to unite, without being smashed to pieces by the hammer; or if so much flies off in scales that the remainder becomes useless. But by the introduction of highly carburetted iron, the oxygen is consumed and the heat thereby retained a little longer; and the metal becoming all good, or restor-

ed, there is rather an addition than a diminution of weldable substance; and a much less use of the hammer will bring the whole into union.

Now, seeing by this means much thinner iron is united than formerly, it is desirable to apply the same process as completely to large work. For though the mechanical obstacles appear so opposite, the opposing agent, (oxygen,) is the same, and is nearly in proportion to the masses.

Small work, being quickly brought to the heat, is less burnt than large masses; for these, requiring much time to arrive at the necessary heat, receive a deeper coat of oxide. Small work, however, is more disfigured in proportion, by the beating requisite to cause union; whilst in large work the quantity of metal between the hammer and joint resists the operation.

In one case the work is worth nothing unless the iron is preserved; in the other the joint is not sound unless oxygen is excluded, because it can never get so much brisk kneading together as to overrule the enclosed layer of oxide, and force union.

A third method I would propose for very large work, is to protect the surfaces in the most convenient manner while coming to the heat; then carefully cleaning them and laying a thin sheet of clean hot steel that has been highly carbonized between them: this would secure a very sound and equable layer of metal all through the joint, the carbon of which, if more than enough to reduce the oxide, would still not impair the soundness of the metal, and consequently do no harm to the joint.

If by some of these means, either of excluding oxygen or removing it in the process, we are enabled to effect a sound union, we may add layer upon layer of sound metal, till we have obtained the largest required mass. Yet this may, perhaps, be only apparently sound; for here another evil is liable to be introduced, which before was stated to need our attention; and if this is allowed to enter, it will increase with every additional layer.

In order to explain this, let the layers be supposed to be added in succession, all on one side of the first, bearing in mind that we are using the thickest layers which our hammer can govern.

When two are welded together, the upper one is stretched most by the hammer; it is therefore pulling the under one with it, which, if it cannot do, it will divide the exertion by curving a little to it. Now here at once the mass is in an unnatural state of tension, the under piece being stretched like a cord, while by its force it is striving to bend the upper one like a bow. Now, a third layer added on this, will, in like manner, be stretched more than the under ones; and while endeavouring to stretch the second one like a cord, it becomes the antagonist of the first, and would overcome its power to bend the second; but as its relation to the second is precisely what the second is to the first, a strong tendency to a curve is still the result. Now, on proceeding to add the fourth, fifth, sixth, &c. layers, we are continually increasing the stretching force on one side. Therefore these additional layers must either all bend, or the under one be so stretch-

ed as to break or become unsound; for the farther the bottom layers are removed from the hammer, the more do they act merely like an anvil, suffering less and less alteration from the hammer.

Now, if instead of adding only on one side, we added as many layers on the three other sides (leaving the first as a central nucleus) while hammering the outside layers, they would all be enlarged; the inner ones serving little more than the office of an anvil, are, therefore, stretched till they break.

This kind of mischief begins with the first welding, and increases with every layer, and is greatly increased by the quantity of hammering required completely to form and finish the work. For the more the outside is extended by the hammer, the more the inner part is stretched; and as this will bear but little of extension without parting, the mass must become unsound. Agreeably with this, it has long ago been observed, that large masses hammered beyond a certain degree lessen in specific gravity instead of increasing, and therefore it was supposed that a large ball might be hammered till it became hollow. Now, whether the layers be added in succession, or are all heated by welding together at once, the effect will scarcely be altered, for it will require as much hammering fully to effect all their unions, and there will be the same gradation of the hammer's effect; for the outside will be drawn out in length more than the inner. This is shown by trying to lengthen a cylinder by a hammer rather too small; for then the centre not lengthening equally with the part directly acted on by the hammer, the ends will become hollow, and the force of the extended outside will stretch the middle parts to unsoundness. The use of enormously large hammers will carry us farther in size before central unsoundness takes place, but then the surface is the more furiously smashed about.

It remains to offer means of preventing or diminishing this central unsoundness; for though in large work the tools would be expensive, yet where the repetitions are frequent, that is of less consequence; and if one ship was saved by the greater strength of its anchor, it would surely be an offset against the most expensive tools.

The bars, which are to be united into one great shaft or stem, should be all of one length and of the full width; then an anvil or bed of iron should be provided, so large as to contain a recess of the same dimensions as the intended shaft. Through the bottom at each end, and flush with it, iron posts might stand so that they could be raised by levers at their bottom when the work required to be lifted out. Now, prepare two of the layers for welding, and put them into the recess, and have a stamper or welding hammer square ended, as wide as the recess, and let it drop from a carriage travelling parallel with the recess; in this case there is no room for extension either in length or width, the metal can only close, and as there is no lateral spreading to make way for the hammer, its force will be directed more effectually downwards; but as its face would be too broad for its best effect, two men, with a frame like a hand barrow, might carry a short cylindrical hammer-like punch under the stamper, and

distribute the blows equally all over. Where this cannot be done, placing the hammer over an anvil, with two heavy cheeks adjustable to the required width, would prevent lateral spreading and lessen the evil, though it could not prevent the longitudinal stretching. But by whatever means the workmen can prevent all extension under the hammer, soundness will be preserved. The above process being performed on two layers, then bring the mass thus produced to a welding heat, and add a third layer, and so on in succession.

If a ball of clay or putty is rolled into a cylinder, it will show hollow ends, proving the outside to have extended most; and the centre being cracked by the stretching, at last breaks the cylinder all through, and it falls to pieces with cracks sharper than the softness would lead us to expect. I have seen brass wire full of cracks at which it would break, occasioned either by very hard drawing or brittleness of the metal, and these breaks were convex, fitting into concaves, showing that the centre had travelled faster through the hole than the outside; for the convex was towards the hole before it had passed, and from it when passed, and the last end of wire is frequently hollow.

Now, seeing large masses are so liable to acquire internal unsoundness, and the weldings also difficult to obtain sound, I would, in constructing anchors, totally avoid all weldings across the pull to which they are subjected when in use.

I would therefore take new iron that has only been reduced to the malleable state, in pieces long enough to forge into the complete form of the intended anchor, without flukes, and thin enough to be quite manageable under the hammer. Having provided a quantity of these, I would weld together (as previously mentioned) by carburet of iron sprinkled between them, a sufficient number to give the required thickness, with some contrivance to prevent all extension, but should prefer a recess capable of receiving the whole anchor. This would produce square limbs, and I should prefer chiselling off the corners to hammering them in; for if they were hammered in, it would put some parts in a state of greater tension than others, and destroy that equal ease throughout, which is so very essential in an anchor, where every part should contribute equally to bear the strain; for those parts that are left in a state of tension chiefly bear the pull, and must give way before the others can come to their full tension; therefore the anchor breaks. Perfect soundness of the iron, an arrangement of the weldings so as to be in a line with the pull and ease of all the parts, or an equality of their state and freedom from tension, are the three most essential requisites in an anchor, after its form has been determined.

From these considerations, I think it will appear that many anchors are rendered unsound by the hammering, and that the metal is liable to be put into such an unequal state of tension, that one part at a time only bears the strain; so that with the weight of a large anchor we have only the strength of a small one; and when this is the case, can we wonder at their breaking?

There remains yet another view in which the use of large implements should be considered; namely, at what thickness can any given material be used with the best advantage. This leads to the inquiry, whether there are any limits in this respect as to thickness and length; and if so, what is their nature, and do any implements exceed those limits.

Now, an anchor is the largest hook in use, and is exposed to rougher, or more violent usage than any other, and that even in proportion to its greater size, on which account it ought to possess every good quality of metal. But I fear this inquiry will show that the largest anchors do exceed the limits of some of the most important qualities.

To seek for these limits, we must look at matter much reduced in size, and compare it with the largest masses, and we shall find a greater contrast than in size.

Small pieces fall from any height without breaking, the blow they give or receive not being equal to the force of cohesion between their particles. Now, on increasing their size, the sectional surface to be broken increases as the square, while the weight increases as the cube, therefore large bodies break from falling.

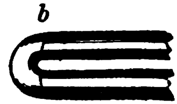
If we sufficiently reduce the thickness of very brittle materials, such as glass, they are found to be flexible: glass may be drawn out so thin or fine as to bear twisting together and forming thread, and it bears throwing about; while the same substance in rods two or three inches thick, will break rather than bear bending enough to be discovered by the nicest measurement.

If we could have wire so small as to consist of one line of particles, it would lose all character of stiffness, and bear unlimited bending (such an imaginary wire may be imitated by a line of small magnets between two large ones;) and if it consisted of three or four lines of particles, no bending could remove them out of the sphere of their mutual attraction; such a wire, therefore, would never break. Now, the smallest soft iron wire bears so much bending about, that it appears, in this respect, more like lead than iron of large dimensions.

This flexibility continues so far, that soft iron wire, about one-eighth of an inch thick, may be bent double, while cold, without fracture. Here the outer portion *a b*, fig. 1, about two thicknesses long, is bent and stretched into the curve *a b*, fig. 2, about double the former length; the fulcrum round which it begins to bend is probably one-third within, but it must ultimately remove to the outside, as will be seen by the figure.

Fig. 1.

Fig. 2.



We may observe that a considerable angle is made before there is much stretching: this is of the greatest consequence, as it immediately engages a longer portion of the metal to stretch and contribute to the bending; for

where there is any curvature the metal is stretched: this will be understood by bending wire into a spiral round a very small axis, when it will have a constant succession of bending parts, and the whole outside will be stretched. Now, after the angle is made, the outer side, while bending and stretching, is forcibly pulled closer towards the fulcrum, therefore, the change of place of the particles is not so great as it appears; and the reason the wire seems not to have lost any thickness at the bend, is owing to the bulging out of the inner side, nearly making up for what is lost on the other; the inner portion is so hardened by the pinch, that there is a little lateral sliding round it while making the bend.

Now, supposing we have begun with the thickest wire that will bend double, let us take some of twice that thickness, the sections of the bending portion will contain four times the surface, but the quantity of metal engaged in bending is eight times as much; therefore the amount of its cohesion is now doubled; and in consequence this wire cannot be bent so much as the other without breaking.

Next take a rod of ten times the diameter of the wire; its sectional surface, the cohesion of which resists breaking, will have increased a hundred times, while the quantity of metal to be bent is increased a thousand times; this is ten times as much in proportion to the cohesion, and the lateral change of place among the particles requires also to be ten times as much: but we supposed the first wire to be the thickest that would bend double, consequently there was all the change of place among the particles that the metal could bear; but in this latter case, ten times the former amount of change of place being required, with ten times the proportional quantity of metal to the cohesion, the rod must rather break than bend.

Steel or iron wire one-twentieth of an inch thick and a foot long, will bear throwing about any how, and suffer little from bending; but if, with the same proportions, the thickness be one foot, the length will be 240 feet, and its weight somewhere about 80,000 lbs.: this, it is evident, could not bear falling from a height proportionally great, or even being lifted from one end like the smaller.

Thus the power of bending decreases as the thickness increases; therefore, in very large masses it is almost nothing; and this same reasoning applies equally to the springing power of large masses.

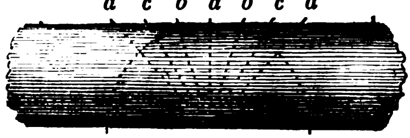
Now, seeing that brittle bodies become flexible by reducing their thickness extremely, so the most flexible bodies become, as it were, brittle by greatly increasing their thickness: therefore, I think we may come to this conclusion, that there is a given thickness at which metal loses all power of springing or bending, and therefore a blow powerful enough to require its yielding will be sure to break it, because it cannot yield in any other way.

We may notice that after a certain quantity of bending, the iron becomes so unequally stretched, that some parts are rendered weaker than the rest; these cannot bear the same exertion, and so must give way.

When a bar receives a blow, or takes one by falling from a great

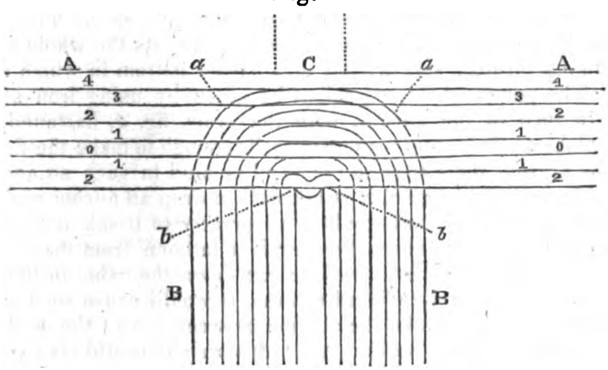
height, it must either spring, bend or break, at the part struck, because the section there is the shortest, as at *a*, fig. 3. Supposing A the fulcrum or blow, the sections *b c* and *d* rapidly increase in length, and therefore soon limit the portion whose strength has to resist or oppose the momentum or weight of the two ends, and when it bends, the section *a* is most stretched, *b c* and *d* successively less as they are longer; therefore *a* is the only part stretched to the utmost; but when a curve is made by a little bending, then there is just so much added that can stretch like *a*, or at least like *b*.

Fig. 3.



It may, perhaps, be allowed here to give another view of what takes place while bending. We will suppose a bundle of square rods A A, fig. 4, perfectly fixed together at their ends, so that they cannot slide, to be forcibly bent as to B B. In this case the rod marked *o*,

Fig. 4.



or one near that place, would simply bend; No. 1 below it would thicken and shorten, while the bottom one 2 would bulge out, making three bends like the letter M; then Nos. 1, 2, 3, and 4, above, would all have to stretch as well as bend, and while their middle was stretching there would be a little sliding round the fulcrum or the two shoulders formed in the lower bars, the upper bar stretching most, and the middle part c in all four of them stretching more than the adjoining parts, as is shown by the sections in fig. 3. Now, if instead of the rods being so small as to bear bending, we suppose each rod to be the thickest that will bear to be bent so much, it is evident they will not bear the additional quantity of stretching and sliding requisite to allow of their taking the form B, B, for the parts *a a* would have to descend to *b b;* a portion *d d*, as wide as the fulcrum is thick, is pulled straight just before rending, and in all cases of bending that straightness is a signal to go no further, for the bar will break.

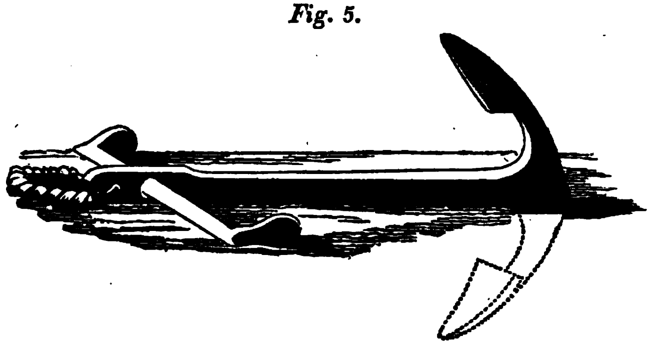
Now, seeing the power of bending or springing decreases as the

thickness increases, and that the weight (the momentum of which endeavours to break any body which falls suddenly on a hard resistance,) increases as the cube while the strength increases only as the square, I think it will follow that anchors ought to increase more in thickness than in size, in order to make up for their loss of flexibility, and enable them to fall without breaking.

This leads us to inquire whether anchors are formed so as to answer equally well their three principal services: the first, to be sure of taking hold; the second, to bear the great strain and jerking to which they are subjected while in use; and the third, to bear falling; and sometimes a fourth, the capability of being withdrawn from a good hold.

With respect to the first, the flukes are probably as broad as the strength of the anchor will bear; for if they were broader, they sometimes would be liablé to be twisted off when the ship swung round with the tide; and the form of the hook is evidently good for taking hold, and running that hold up to the shank; but as the fluke is the chief resistance, the arm should begin to curve from the fluke gradually into the shank: but the wooden stock which obliges the anchor to take hold, offers as much surface to the ground as the fluke does; this added to the rising angle of the pull, prevents the whole anchor from diving through soft ground to a harder bottom in which it can hold. The power of diving might be given by using iron stocks, made to turn in the anchor, with the arms, fig. 5, flattened, and round disks at their ends turned inwards enough to make the flattened arms present their edge to the sand or mud in such an angle as to be able to dive. Again, it is not well to drop an anchor with any additional weight, as that would tend greatly to break it; but if a stop were put on all cables three or four fathoms from the anchor, and a weight like a collar allowed to run down the cable to this stop whenever the anchor was found to drag, it would cause such an angle in the cable as to make the portion between it and the anchor lie on the ground and pull horizontally: this weight would also act like a spring, for when the ship tugged at the cable, endeavouring to straighten it, it would have to raise the weight before the anchor could feel the tug, and then it would never be so sudden or so much upwards as without a weight.

Fig. 5.



With respect to the second condition, the action of a hook is the severest strain that metal can be put to; therefore, nothing but the most careful gradation of form, regularly increasing the strength from the stock to the bow and from the fluke to the shank, and curving the shank better into the bow or arms with really sound metal, can distribute the strain equally.

Thirdly, the bearing a fall: an anchor is so formed that it cannot drop on a hard bottom without strain somewhere; and as we can only meet this by increasing the thickness more than the size, and as with this thickening it will be gradually losing the form of an anchor and approaching that of a block, it becomes a query whether, for the largest anchors, Parks' mooring block (which was rewarded by the society in 1818, vol. 36,) is not the best, weight for weight, because it will dive till it finds hold, and a stopper may be put on the cable to prevent it from diving too deep to be easily withdrawn.

There are two somewhat similar operations by which metal is fitted for our use, that deserve our consideration, because in one it evidently loses strength laterally, although it gains it longitudinally. These are wire drawing and rolling out into plates: in one case it is drawn through holes successively reduced in size; in the other it is drawn between hard rollers successively placed nearer to each other.

This produces a character rather extraordinary for metal, for it becomes fibrous; and this texture may be satisfactorily shown, by submitting a piece of it to the slow action of weak acid. Some have attributed it to crystals which kept their separate character while being elongated. But if we carefully trace the progress of the metal through the holes or between the rollers, we may probably find sufficient cause for an elongated or fibrous texture.

The metal is caused to pass through the holes by pulling and not pushing; therefore the quantity reduced each time must be small compared with the thickness of the wire, because it is the mere tension of the reduced part which causes a complete change of place among the particles, or the squeezing of larger rings or short cylindrical portions successively into a smaller size, and elongating them in proportion. This elongation takes place in the hole, where the metal is stretched nearly to the utmost, and it may be considered as analogous to drawing a cylinder or core out of a tube; and this core is so much stretched as to receive into itself the whole of the outer coat, which thus sinking in becomes part of it and follows by its cohesion. Now, as these successive rings are too large to go through the hole, they cannot contract and dive into that below but by a longitudinal sliding of the particles, some sliding aft to let the others close and proceed through the hole. Now, as the elongation is unlimited while there is room to reduce, the centre would be torn asunder, did not the outer metal dive and fill it up; then, as cohesion, or the power which resists parting, is the cause of this, the whole portion at the hole may be considered almost as in a liquid state while passing through it. During this motion and change of place among the particles, if there is any sort of polarity in them, this is the time they are called into action, and can arrange themselves, and

that arrangement must be longitudinal; but the longitudinal sliding of the particles to allow some to proceed first through the hole, and the continual wedging of portions of the outside into the central parts to supply the current of particles through the hole, (for it is like a current,) the particles re-arranging themselves and following by mere cohesion, appears sufficient to produce a tendency to longitudinal fissures, by which the coherence is somewhat weakened, although no real division takes place.*

In the flatting mills the revolution of the cylinders helps to carry the metal through; in that it differs from wire drawing; but though there are no side stops, the metal scarcely spreads any thing in width, proving that there is no pressure of the particles together laterally, but that the mass is elongated just as the thickness reduces; here the rollers pinch tight the reduced part and forcibly carry it through; while the thicker part, like a wedge, refuses to follow, so it is stretched somewhat like wire drawing and the surface is driven back in waves. Here the whole action is lengthwise, and each line extends without regard to its neighbouring lines, so that its lateral adhesion is weakened; and as a thin plank will bend lengthwise, but will split rather than bend crosswise, so will hard rolled plate metal. Annealing and hammering once or twice till hard again, by distributing the extension in all directions, removes this parallel fibrous character. This change of character, according as the metal is worked, shows that none is so strong as that which is beat in a recess; and I think no fibres could be discovered in such metal; for, if I may use the expression, it would be one fibre spreading every way; in fact, it becomes quite dense and homogeneal.

I have now endeavoured to show that oxygen entering with each welded surface deteriorates the iron; and have proposed some and pointed to other means which have been found capable of avoiding it.

Also, that the difficulty of transmitting the force of the blows to the inner surfaces increases with the thickness, and therefore limits the thickness at which sound welding can be obtained.

And when the hammer is used for lengthening a mass, the outside is chiefly elongated, from the effect of the hammer regularly decreasing as the centre is farther from the surface; so that, at last, it receives no impression, but, with the mass below it, serves only the office of an anvil, merely helping the hammer to extend the outside, in which case the centre always becomes stretched, and thereby weakened, and sometimes torn asunder; and as each side while

* When reducing some thick wire in the lathe, to make a small screw with a large head, it proved so unsound at the centre as not to bear reducing to the required size; it did not break off, but tore aside; and on twisting it about with the pliers, the whole of the reduced portion appeared fibrous, so that the wire seemed to have a pith within it. In this instance the centre must have stretched more than the outside could supply while drawing. It would be desirable to try which would give the soundest centre,—the reducing wire through the fewest possible number of holes, or greatly increasing their number and bringing the wire down very gradually; then drawing some very slowly, and some as quickly as possible.

lengthening under the hammer endeavours to bend the mass, it causes an alternation of the stretching, or springing, so as to facilitate the cracking of the centre.

Thus, while small masses are rendered dense and stronger by the hammer, large ones suffer loss of strength if very much hammered.

[TO BE CONTINUED.]

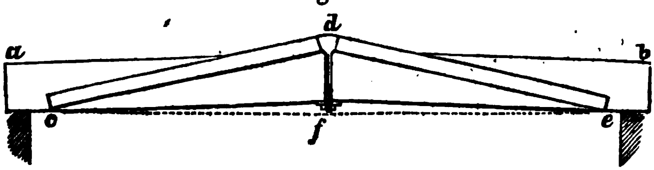
¶ METHOD OF TRUSSING GIRDERS.

The thanks of the Society were voted to ALFRED AINGER, Esq. *of Doughty Street, one of the Chairmen of the Committee of Mechanics, for the following description of a cheap and simple mode of adding to the strength of girders and other wooden beams.*

THE plan of *trussing*, which it is the object of this paper to explain, was first submitted to the Society in 1824, and several models were subjected to actual experiment, on a tolerably large scale, the results of which will be noticed in the proper place. It appeared, however, that a method of strengthening timbers, similar in principle, and not very dissimilar in detail, had been practised in Scotland, though it was very little known, and less used, in the south. Mr. Ainger's plan, not having been at that time applied to any building, was, in consequence, withdrawn: since that period the suggestion has been realized with so much success, as to render it not improbable that a statement of the economy, simplicity, and effect combined in this method might be usefully published.

The mode of trussing girders, which is exhibited in all the old books on carpentry,—which was extensively and exclusively used till within a very few years, and which is still frequently used,—consists in the addition of an arch-like arrangement of wood or metal, upon the resistance of which alone the strength of the girder is made to depend, the main timber itself forming little more than the support and the abutment of the included arch. This mode is described in fig. 1, where *a b* is the main timber, and *c d*, *d e*, are two inclined

Fig. 1.



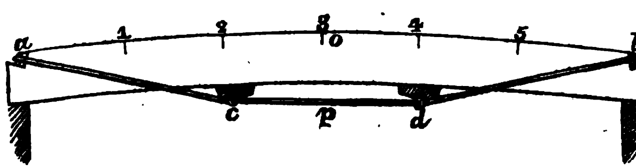
struts or braces, resisted at their lower extremities by plates of metal inserted into the timber, and which support the middle of the beam by means of the screw *king-bolt d f*, by the action of which the girder is bent upwards, or, as it is called, *cambered*, in the manner shown in the figure. When this is done, it is evident, not only that any weight laid on the girder must eventually press upon the king-bolt and the braces, but that the timber itself, on account of its bent or

cambered form, is also exerting a great pressure on the king-bolt, which is likewise transferred to the braces. It is equally evident that, until the girder has sunk in the middle so far as to assume a straight line, it can support no part of the load, but is itself a load upon the braces: a very little consideration will serve to show the inadequacy of these to the strain thus imposed upon them. Their resistance, of course, depends upon preventing their bases *c e* from separating or spreading laterally; in preserving, that is to say, the dotted line *c e* of the same length; and this effect seems, at first sight, to be accomplished by the lower edge of the timber: it is supposed to be so in the calculations made of the strength of girders trussed in this manner. But in order that the lower edge of the girder should act the part thus assigned to it, the woody fibres at that edge must be in a state of tension, like a heavily-laden chain or rope. Those fibres are, however, in a state of compression instead of tension, inasmuch as they occupy the concave edge of the beam, which is, of course, shorter than the convex edge; the resistance to the braces must take place, therefore, higher up in the beam, perhaps nearly in the middle of its depth,—a circumstance which would alone destroy half the estimated strength of the girder.

Notwithstanding these obvious defects, this mode of trussing continued to be much employed till about the year 1816, when Mr. Barlow, among other valuable experiments, compared girders, trussed on the principle above described, with a plain piece of timber of the same size, and found the latter to be on the average not considerably weaker. Since that time, therefore, in all well-executed works, the lower ends of the braces have been connected by an iron rod in the dotted line *c e*, which may, of course, be brought to any state of tension by means of screws or keys. With this addition the truss is perfect in principle, and its strength is limited only by the strength, substance, and workmanship, of the materials employed. It is, however, difficult, and somewhat expensive to make, in an effectual manner; in consequence of which, and partly, perhaps, in consequence of ignorance of the defects of the old plan, the latter is still too frequently employed. The method proposed and adopted by Mr. Ainger is at least as economical as the old plan; and, though not so powerful as that which is composed of iron braces and a horizontal iron connecting-bar *c e*, will be found to add very greatly to the strength of the timber, and at a very small expense.

Fig. 2 is copied from a girder actually in use, 34 feet long, which supports a leaden flat, and which has not altered sensibly during the two years it has been applied. As before, *a b* is the timber, bent

Fig. 2.



upwards or cambered to about the same extent as in the former case. The trussing consists of a series of iron rods *a c d b*, pulling against iron plates notched into the timber at *a* and *b*, and connected at *c* and *d* by bolts similar to those of a suspension bridge, the rod *c d* being double, to embrace the ends of *a c* and *d b*. The rods *a c d b* form, in fact, a suspension bridge, supporting, by the bolts *c d*, the middle of the girder, the ends *a* and *b* being prevented from approaching by the opposition of the woody fibres at the upper edge of the timber. If, however, this were all, it is clear that the girder would have a defect exactly the counterpart to that described in the last case. The cambering would cause the upper fibres to be in a state of extension; they would, therefore, rather promote than resist the approach of the points *c f*, and the resistance must take place, as before, nearly in the middle of the depth. But in this case the objection is very easily and completely remedied by merely cutting notches, about one-third of the girder's depth, in its upper edge, as 1, 2, 3, 4, 5, and filling them, after the girder is bent, with thin wedges of hard wood or metal forcibly driven in. By this means the upper edge of the girder is put into the best possible state to resist, by its anti-compressive force, the tension of the iron rods, the strength of which alone limits the strength of the girder.

For calculating the size of the iron rods proper to be applied in any particular instance, the following will furnish an example:—Good wrought iron tears asunder with a force of about 28 tons on each square inch of section; but it extends sensibly with half that weight, and should not in practice be loaded with more than one-fourth, or 7 tons per square inch. The depth of a girder, such as fig. 2, may be represented by the distance from the middle of the notch 3 to the middle of the bar *c d* or from *o* to *p*: suppose this depth so measured to be 14 inches, suppose the length of the girder between the bearings to be 34 feet, and suppose it subject to a load on its centre of five tons: the requisite area of section for the iron bars in square inches would be, in that case, $\frac{204 \times 2.5}{7 \times 14} = \frac{510}{98}$, or $5\frac{1}{4}$ nearly. Here 204 is half the girder's length in inches; 2.5 is half the load on the centre in tons; 7 is the practical strength of each square inch of wrought iron in tons; and 14 is the depth of the girder, taken, as before described, in inches. If the load be uniformly distributed over the length of the beam, its effect will be equal only to half the same load placed in the centre. Five tons distributed thus, in the case just described, would give, as the requisite section for the iron bars, $\frac{204 \times 1.25}{7 \times 14} = \frac{256}{98}$, or rather more than $2\frac{1}{2}$.

In the experiments alluded to, a fir beam, 8 inches square, 12 feet long between the supports, and strengthened by iron rods one inch square, applied in the manner just described, was found to support a weight of between 4000 and 5000 pounds, being more than double what it could sustain without the trussing. A girder of the same size, trussed with iron braces as in fig. 1, and with an iron tie bar one inch square in the dotted line *c e*, exhibited no greater

strength to resist fracture, though its deflexion under similar loads was, of course, less, inasmuch as the compression of iron must be less than that of fir.

I am, sir, &c. &c. A. AINGER.

A. AIKIN, Esq. *Secretary, &c. &c.*

[*Trans. of Soc. for Encouragement of Arts.*

¶ *The Carpet Manufactory of Baarn, in Holland.*

Extracted from the letter of a Belgian traveller to a friend at Brussels, and translated by the latter for the Mechanics' Magazine.

"THE progress of national industry is a subject as you, my friend, are aware, which is too near my heart, for me not to devote a part of the time I had to dispose of, during my short residence at Soestdyk, (in the environs of the palace of the Prince of Orange,) to visit the far-famed Royal Manufactory of Carpets, in the delightful village of Baarn, a mile and a half (English) from the palace; to which I was the more induced that I have the satisfaction to be acquainted with the Director, Mr. E. G. W. Cohen, a man of genius, and of universal knowledge.

"This manufactory presented nothing extraordinary till it became under the direction of Mr. Cohen; but since then it has attained a degree of perfection not exceeded, if equalled, by any similar establishment either at home or abroad.

"I first visited the dying house, which is furnished with a great number of immense boilers, constructed after the best plans; then the place where the colours are prepared; and next the laboratory where preparatory experiments are first made on a small scale. From these we passed to the work-shop, where all the instruments and machines, from the smallest to the largest, are constructed and repaired. Such is the diversity of objects here, that, at first sight, the visiter imagines himself transported to a repository of arts and trades, or into a vast establishment composed of many workshops united. The best turning lathes, dividing machines, chronometers, and michrometers, engage your attention; then there is a foundry, a forge, a carpenter's shop, &c. &c.; every thing, in short, necessary for constructing and keeping in order the multifarious objects used in the manufactory.

"To describe to you that manufactory itself—the carding, combing, roving, stretching, spinning, reeling, doubling, and turning machines—were an endless task; suffice it to observe, that the machinery is all constructed according to the latest improvements, and all made on the spot, yet in such high perfection as to leave but little, if any thing to desire.

"The products of the manufactory are of great variety. The principal descriptions are as follows:—

"Brussels carpets, with single and double ground and threads.

"Velvet pile, or Wilton carpets, of arabesque, half superior, supe-

rior, high superior, and imperial qualities, with single, as well as double ground, and threads.

"Smyrna or Turkey, and Persian carpets, of different qualities.

"Savonnerie carpets, which rival the richest embroidery or most elaborate painting in execution of figures, flowers, and designs.

"Kidderminster, Venice, jaspé, and cow hair carpets, rugs, staircase carpets, &c.

"Of these, and other fabrics here manufactured, the warehouse in Amsterdam contains many thousand varieties, and of all qualities, so as to suit every rank—the peasant's cot as well as the nobleman's palace.

"They showed me a carpet intended for a drawing room in the royal palace. It would be difficult to imagine any thing more beautiful produced by human labour; the elegance of the pattern, the harmony, brilliancy, and variety of the colours, were surely never surpassed. Another carpet, of a double ground, contained, I was told by the workman, forty-five colours; and I was assured that this magnificent carpet was composed of 243,000 worsted threads, alternately united and detached from each other. This carpet was purchased by the king of the Netherlands, and sent, as a valuable present, to the king of Prussia, and it now adorns one of the finest apartments of the palace in Berlin. A third masterpiece, destined for an altar piece in a church, representing the *Madonna de la Sedia*, of Raphael da Urbino, was a faithful copy from the beautiful and famous copperplate engraved by Raphael Morghen. It was entirely executed in the common weaver's loom, brought to a colossal size to produce a striking effect. This piece was made in a much more ingenious manner than the Savonnerie carpets; the latter are done on a standing chain, and the colours drawn by hand—but the former was worked entirely (with 130 colours,) in the common weaver's loom.

"Some of the Turkey, Persian, and Savonnerie carpets, are worked (*à haut lisse*,) with a perpendicular, or standing shaft, where the colours are arranged by the hand of the workman, and immediately worked in the chain by the loom.

"One of the finest inventions used in France, in manufacturing figured silk, has been here applied with admirable effect. This invention, in utility, may compete with the cotton spinning frames of Arkwright, with Bolton & Watt's improved steam engine, or with Cartwright's ingenious invention of the power loom; while with regard to the variety and multiplicity of designs it executes, it surpasses incomparably all the old methods. And yet it is but a simple machine, having neither wheels nor screws.

"It is known that in order to produce the figure in any weaving, the threads must be successively drawn in a certain order till finished; and it is this which has given rise to the operation called drawing, which consists in pulling up, after each throw of the shuttle, in a prescribed order, one of the threads necessary in the formation of the figure; an operation usually done by apprentice boys. With the machine which I have just mentioned, all the inconveniences of the drawing not only by hand are avoided, but many other advantages are

obtained, which gives the highest perfection to this art, and such as it never could have reached by the old method.

"An establishment of so much importance was worthy the patronage of the government, and it has accordingly honoured it with its special protection. The director, who is a member of different royal societies of arts and sciences, obtained at the exhibition of Ghent in Flanders, in 1820, the silver medal. At the last exhibition at Haarlem, in 1825, he also received the silver medal; besides various medals for several inventions and improvements in the manufacturing of cards for wool and cotton. The royal society of Haarlem for domestic economy, assigned to the director of this fine establishment of national industry, its medal of honour; and at the exhibitions both of Ghent and Haarlem, the king purchased many of the principal specimens produced by the manufactory."

Plan for giving buoyancy to Chain Cables. By John Pole, Commander H. M. S. Maidstone.

The advantage of a hemp cable over a chain one consists in its yielding more readily. Whenever a chain cable forms a curve it requires a great power to draw that curve to a straight line. In moderate depth of water, the curve formed by the chain is very considerable; but in very shoal water, as Table Bay, where ships anchor in four fathoms, and lay nearly with 100 fathoms cable out, the cable is then nearly horizontal, and supported in a straight line by the ground; consequently when the ship receives a blow from the sea it can yield little or nothing, and it snaps. Now, I propose that in very shoal water, as the cable cannot form a natural curve, to make an artificial one, and I think in a very simple and efficient manner. Every ship has always a few empty water casks at hand; four or five good sized casks, would be quite enough, and any thing of a buoyant nature might be employed in aid of them. These casks should be kept slung with a hook and thimble in the lower part of the slings, and when coming to an anchor in moderate weather, I should veer out a moderate quantity of cable, and when it comes on to blow fresh, as I veered I would hook on a cask at every ten or fifteen fathoms, according to the size of the cask and weight of the cable. These casks, from their buoyancy, would festoon the cable when it became slack, and when the ship was forced astern again by a blow from the sea, she would have to pull each of these casks down, and also astern, as every cask would be farther from the anchor with a straight cable than when festooned. In Table Bay there is an under tow setting out, and there is the same, I believe, in all bays when the wind blows strong into them; which under tow would also make a resistance to the casks, as the vessel drew taut her cable, and the ship would then be regularly eased to her anchor, and no sudden shock could be felt. I think a table might be computed to show how much buoyancy it would require for a certain length of cable in a certain depth of wa-

ter to give the most desirable curve; and in fact I think you may give any elasticity you like to a chain cable by this simple method.

These casks, it must be recollected, will be below the influence of the sea, and cannot be injured by it, and the only strain they will feel, will arise from their own buoyancy. After the gale was over, you would, of course, heave in to your usual length of cable, and take the casks off.

Merchant ships find the advantage of chain cables in so many ways, and there are so few objections to them beyond their liability to snap in shoal, and also in very deep water, that if any simple method could be devised to do away with these objections, there can be no question of its great utility. Whether festooning the cable, as I propose, in very shoal water, and in very deep water giving the cable a certain degree of buoyancy to relieve the ship, will have that desired effect, I will leave others to judge.

[*Mech. Mag.*

¶ *First Report of the Proceedings of the British Association for the Advancement of Science, assembled at York.*

[Continued from p. 9.]

The same views are, perhaps, still more happily presented in the following paragraphs, which we really hope will go far to do away with the erroneous impression, still existing in some quarters, of an intentional interference on the part of the new institution with other scientific bodies.

"But there is a defect in these separate societies, in respect to their own immediate objects, which I am sure no member of them would wish to dissemble, and which arises from the narrow basis on which they are of necessity built. It is not only, that the constant converse of men, who, to borrow the expression of Goldsmith, have often travelled over each other's minds, is not half so effectual in striking out great and unexpected lights, as the occasional intercourse of those who have studied nature at a distance from each other, under various circumstances, and in different views; but it is also, gentlemen, that none of our existing societies is able to concentrate the scattered forces even of its own science; they do not know, much less can they connect or employ, that extensive and growing body of humble labourers who are ready whenever they shall be called upon, to render their assistance."

"What numberless suggestions, what a crowd of valuable but abortive hints are continually floating in the thoughts of philosophers, for the pursuit of which time is wanting to themselves! Now I say, gentlemen, that we have among us, scattered through the country, men willing to adopt these unexecuted hints, as they arise out of the profound and varied meditations of more experienced minds, men not incapable of surveying with accuracy a limited district, though they may not pretend to draw the general outline of the map, or fill up the whole of its details. Many such there are who only wait for

instructions, and who require no other stimulus than that of being invited, to render the most essential service to researches and calculations of the highest order; and it is upon this ground especially that we venture to pronounce an institution wanting, which shall not hesitate to make such invitations and to offer such instructions; it is upon this ground that if we now propose to revive in the nineteenth century a plan devised two centuries ago, we see a difference, gentlemen, in the probability of success. Scientific knowledge has of late years been more largely infused into the education of every class of society, and the time seems to be arrived for taking advantage of the intellectual improvement of the nation. Let philosophy at length come forth and show herself in public; let her hold her court in different parts of her dominions, and you will see her surrounded by loyal retainers, who will derive new light and zeal from her presence, and contribute to extend her power on every side.

"Much, indeed, is not to be gained in the more recondite subjects of investigation from the first essays of inexpert inquirers; but let the number of those inquirers only be increased, collect around you, gentlemen, a school fired with a zeal for truth, confess to them how little you know compared with what remains to be known, apprize them that there is not a subject to which they can apply themselves where new materials are not wanted to advance the fabric or secure the foundations, let them see that the more multiplied have been your discoveries, the more additional openings to discovery have appeared; and if you will then draw the pencil line of what is, and what is not, made out in every science, if you will indicate to them those prominent points and *inlets* of inquiry which bid fair to lead to promising results; if you will thus put before them right subjects, and at the same time suggest the right method of treating those subjects; whatever more may be wanting to accurate and successful investigation, natural sagacity and a longer experience will easily supply to men possessing only common abilities, and walking in the common paths of life."

We feel that we should discharge but imperfectly our duty in disseminating as widely as possible the objects of this report, did we not transfer to our pages the recommendations of the sub-committees of the association upon different branches of science, who are in fact the active organs of the association, forwarding its scientific objects, and providing the intellectual occupation of its successive meetings.

[*Brewster's Journal.*

¶ *On the use of Heated Air and Uncoked Coal in the Smelting of Iron Ores.*

The journals have lately announced the discovery in France of a method of smelting iron ore with billets of wood uncoked, from which a great saving of expense is anticipated. This discovery will prove of high value to the iron smelters in foreign countries, especially in the north of Europe. But to the British smelters it is vastly inferior

in importance to the process now employed at the Clyde Iron Works, by which iron of an excellent quality is obtained at once, and in much larger quantity than formerly, by the employment of raw uncoked coal. The agent in this remarkable amelioration of the smelting process is heated air, with which the blast in the furnace is kept up instead of the cold air hitherto propelled into the furnace. The iron, when withdrawn, is much more fluid than when smelted by the old process, and in this respect has much resemblance to the Silesian iron of the first fusion. The value of this happy application, in an economical point of view, may be seen from the following circular drawn up by the patentee.

Comparative view of the quantity of materials required at Clyde Iron Works to smelt a ton of foundry pig iron, and of the quantity of foundry pig iron smelted from each furnace weekly:

	Coals in tons of 20 cwt., each cwt. 112 lbs.	Iron-stone.	Lime-stone.	Weekly produce in pig iron.
1. With an air not heated and coke, - -	7 tons	$3\frac{1}{4}$	15 cwt.	45 tons.
2. With air heated and coke, - - - - -	$4\frac{3}{4}$	$3\frac{1}{4}$	10	60
3. With air heated and coals not coked, - - -	$2\frac{1}{4}$	$3\frac{1}{4}$	$7\frac{1}{2}$	65

Notes.—1st. To the coals stated in the 2d and 3d line, there will fall to be added 5 cwt. of small coals, that being required to heat the air.

2nd. The expense of the apparatus for applying the heated air will be from £200 to £300 per furnace.

3d. No coals are now coked at Clyde Iron Works; at all the three furnaces the iron is smelted with coals.

4th. The three furnaces are blown by a double powered steam engine, with a steam cylinder forty inches in diameter, and a blowing cylinder eighty inches in diameter, which compresses the air so as to carry two and a half pounds per square inch. There are two tuyeres to each furnace. The muzzles of the blow pipes are three and one-eighth inches in diameter.

5th. The air is heated to upwards of 600° of Fah. It will melt lead at the distance of three inches from the orifice through which it issues from the pipe.

[*Brewster's Jour. of Sci. No.* 12, *April*, 1832.

On the Manufacture of Sulphuric Ether.—C. Wittstock.

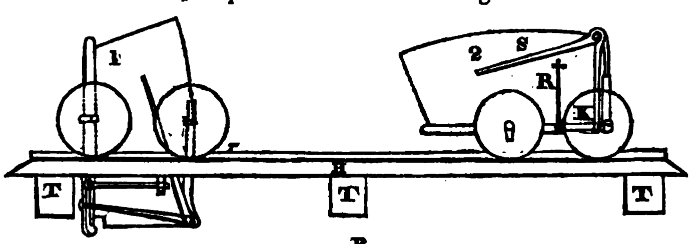
The remark of MM. Fourcroy and Vauquelin, that the sulphuric acid employed in the fabrication of ether undergoes very little change, led to the conclusion that ether would be formed as long as there was a fresh supply of alcohol to the acid. This supposition was confirmed by the experiments of M. Gay Lussac; and since then the fabrication of ether has been considerably improved by MM. Boullay, Geizer, and others. I have for some time employed the following

method; and as I am disposed to consider it more simple and less expensive than any other, a short description of it may perhaps be acceptable to the reader.

A mixture of nine parts of sulphuric acid, (s. g. 1.84—1.85,) and five parts of alcohol, (s. g. 0.835,) are put into a green glass retort of one foot in diameter, with a glass tube inserted at its upper part. This tube is four lines in diameter, and bent at a right angle; the shorter arm, which at its extremity, has only one line in diameter, is plunged one inch deep in the mixture; the longer arm, of about three or four feet length, with a cock near its further end, leads into a bottle, with alcohol. The receiver consists of a refrigerator, viz. a wooden tube filled with water, by which the distilled ether is kept cool, and two copper vessels, the one within the other, so that there is a distance of about two inches between their sides. The neck of the retort leads into the intermediate space between the two copper vessels, which is thus filled with the distilled liquid, and from which the liquid may flow off by another tube. The apparatus is used in the following manner:—When the mixture is boiling, the cock of the glass tube is opened, and the supply of alcohol thus kept up, so that the quantity of liquid in the retort remains always the same; this is continued until eight times the original quantity of alcohol has been used, which will be the case in about twenty hours, if the original mixture consisted of 25 lbs. of sulphuric acid, and 14 lbs. of alcohol. The first rectification of the ether thus obtained yields about its third of ether of .725 sp. gr. which may of course be considerably increased by repeated rectifications, besides about twenty to twenty-five per cent. of alcohol are regained, which may be subsequently used again, particularly for the supply of alcohol to the mixture.

Of 124 lbs. of alcohol of 0.835 sp. gr., 22 lbs. were regained; the quantity of pure ether of 0.720 to 0.725 sp. gr. at 14° R. amounted to 59 lbs., and of sulphuric acid 25 lbs. were used. The expenses of fuel, apparatus, attendance, &c. does not raise the price of the ether to more than twice that of its weight of alcohol.*

¶ *Improved Excavator's Wagon.*



Sir,—The accompanying sketches represent an improved sort of wagon, which was used for removing the earth at the excavation of

* Extracted from Poggendorff's Ann., Band xx. St. 2, page 461.

the new entrance to the London Docks. It is a well known fact, that if clay is mixed with water and a little sand, it forms so compact and cohesive a mass, that when carted to a distance of two or three hundred yards, it is next to impossible to uncart it without the help of pickaxe and shovel. The soil to be excavated in the present instance being very much of this description, it was the general opinion that the ordinary kind of excavator's wagon would be of little use; and being in the employment of the contractor for the work, I therefore set about contriving such an alteration in the construction as might meet the difficulty of the case. After several trials, with different models, the one of which I now send you a description was found the most suitable. We had a good many wagons constructed on this plan; and I was very happy to find, that when the mode of using them came to be understood by the workmen, they answered our purpose admirably.

Description.

Fig. 1 is a side-view of the wagon when emptying. B, shows the line of the barge at high-water. TTT, are whole timbers. H, are half-timbers on each side of the wagon to secure the iron rail, *r*. The distances from TT, and also between the rails, are left open, to allow the tail of the wagon to drop through, as in fig. 1.

Fig. 2 shows the method of securing the tail-board at top and bottom. At J is a joint, to allow the wheels to run out, and at K a catch to secure the axle; *s*, is a strap, bolted to the side to secure the tail-board at the top.

The course followed on emptying the wagons was to push them forward to one of the timbers, as at T, and then to allow the bottcm to slide down the timber gently. A man on each side then pulled up the rods, as at R, which lowered the catch K, when immediately the wheels went out, down went the wagon, and the earth dropped out. Nine times out of ten the clayey mass went down into the barge as solid as if it never had been dug. I had almost forgotten to add, that the wagons were about four inches wider at the tail than at the head. The drawings show the axles bent, but they were not all so; the more bent, however, the axles are, the more easily the wagons are managed.

Yours, &c. J. Walker.

[*Mech. Mag.*

The effectual consumption of Coal Smoke, and a mode of erecting Fire-proof Dwellings, without the use of Iron Beams.

To the Editor of the London Morning Chronicle.

Sir,—In your paper of to-day I observe a paragraph which goes to prove, from M. D'Arcet's observation, that the air of the metropolis is contaminated by sulphuric acid. This will always be more or less the case while open fires are employed; but a description of furnace (Witty's,) has recently been invented, which, in all close fire-places, such as stoves for cooking by ovens, or by hot plates, in

the French manner for heating rooms; or furnaces for heating water, producing steam, &c.; in short, in any case excepting where fires in open grates are indispensable, completely burns the smoke. So many inventions for this purpose have been produced and failed, or have acted only partially, that I should have hesitated to mention the present one, if I could not refer your readers to Lee's Nursery, Hammersmith, and Henderson's Nursery, Edgware road, where Witty's furnaces may be seen in operation, and where they will be found completely to verify my assertion, by burning the whole of the smoke produced from the fuel. Were these furnaces used in all cases of close fires in the metropolis, it is evident that the quantity of sulphuric acid in the atmosphere would be materially diminished.

But there is a great ulterior advantage which will, sooner or later, result from these furnaces, and which their inventor probably never contemplated. That is, that every family employing one of them for heating a room, for boiling water, for close cooking, for heating a green-house, or for any similar purpose, may produce in them as much coke from common coal as will serve to supply their open fires, and thus these also will produce no smoke, not even when first lighted. Here then is a very simple, economical, and effectual mode, alike applicable to rich and poor, of getting rid entirely of the coal smoke of the metropolis, and of every other town in the empire. Here also are the means suggested of putting an end to climbing boys and smoky chimneys.

Supposing, however, that there were some private or poor families who did not, or could not, afford to prepare their own coke, or who did not use a close fire sufficiently often to prepare enough, there would, no doubt, be others who might prepare more than enough, and sell it; because it is proved that in this preparation 30 per cent. of the fuel is saved which in open fires and common furnaces is lost.

I hope that when government have their more weighty matters arranged, they will appoint a committee to examine how far it may be adviseable to compel the use of this invention, or preclude the use of all coal not coked. This would render the air of our cities and towns as free from smoke as that of the towns on the continent.

While on the subject of general improvement, I may mention another invention, which I consider of very great importance, viz. a mode of building fire-proof houses of any size without the use of iron or any other metal, as durable as stone or brick, and cheaper than buildings composed of the usual materials.

The inventor is Mr. Frost, 6, Bankside, Southwark, near the bridge, where a small house, illustrative of his invention, may be seen, or at least was seen there by me some months ago.

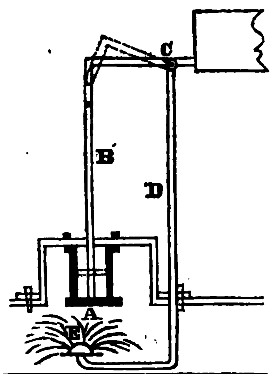
I enclose proofs of some paragraphs which I had prepared on both these inventions for the Gardiner's Magazine, and for an intended work on Labourer's Cottages, which you may use, or not, as you please.

I am, Sir, your most obedient servant,

J. C. Loudon.

Bayswater, January 19, 1832.

Quick-acting Safety-Valve for Steam Boilers.



SIR,—Having had frequent occasion to observe a repugnance to the employment of steam for heating buildings, &c., on account of the risk of accidents from explosion; and as many accidents have actually occurred from this cause, I send you a description of a quick-acting safety apparatus, which I shall be glad to see inserted in your valuable publication.

Yours, &c. DUNBAR.

London, Feb. 24, 1832.

Explanation of the Engraving.

When the steam issuing from the boiler, through negligence or other means, gets above any required pressure, (which may be regulated by the loading of the piston,) it acts more or less according to its force upon the piston A, which raises the rod B, and opens the cock C; the water then flows from the cock through the pipe D, and is dispersed in a shower by the rose E fixed on its end, which causes an immediate condensation. The condensed water flows into the boiler, and causes a reduction of temperature. The overplus of water which flows into the boiler, may be let out by means of a float connected with a cock.

This apparatus may be fixed in any convenient part of the piping, by screwing the box on to the pipe, as shown in the sketch. And it is not subject to sticking as the common valves are, (of which there was lately a melancholy instance at Newcastle,) as it will be almost continually on the *qui vive.* D.

[*Mech. Mag.*

¶ *Steam-Boiler Explosion.*

On Thursday, the 22nd of March, the extensive calender house of Messrs. Goodier and Co. of Manchester, was almost entirely demolished by the explosion of a steam-boiler, five persons killed, and many others severely wounded. On the forenoon of that day, the engineer discovered that the eccentric motion which worked the steam-valves had sustained some injury; a millwright was set to repair it; but as it was expected the repair would be completed in the course of the afternoon, moderate fires were kept under the boilers, and the steam kept up. The works were driven principally by an engine of 32-horse power, not a high-pressure one, but a condensing-engine of the best kind, made by Boulton and Watt; and it was worked at a pressure never exceeding 12 lbs. on the square inch. It was supplied with steam from two twenty horse boilers, which were placed side by side transversely across the cellar of the building. The safety valve is stated to have been five inches in diameter, and to have been loaded with 224 lbs. being about ten pounds to the

square inch. But it seems there were no safety valves on the boilers themselves, but one upon a large pipe which conveyed the steam to the cylinder. Between that pipe and the boiler were stop cocks, so that each boiler could at pleasure be shut off from the pipe. It is supposed that one or both of the boilers had been thus shut off, for the convenience of making the repairs. If so, the steam could not act upon the safety valve, and the pressure becoming too great, an explosion was the necessary consequence. In 1828, an explosion took place from this very cause at the factory of Mr. Thomas Kearsley, at Tryldesley, by which ten persons were killed, and great part of a new and extensive building demolished. [*Manchester Paper.*

Manufacture of Salt.

Sir,—I beg leave to intrude upon your valuable columns, by presenting your readers with some observations on the manufacture of salt, part of which I have transcribed from a French work, written by M. Berthier.

The salt works at Moutiers, (in the department of Mont-Blanc,) have four graduation houses, with faggots in the usual manner, and a fifth with rope: which method was invented some time back, by Chevalier Dubuet. These buildings are erected in a narrow pass into a valley. The rope graduation house is built in the form of a crescent, in order to favour the action of the wind: it is ninety yards long, of which only seventy are occupied by the ropes. The top of the building contains 259 wooden channels, thirteen yards long and five inches wide, and having the same distance between them. Each of these channels is furnished with twenty-three endless ropes, 0.007 to 0.008 metres (.3 inch) diameter, which pass through holes made in the channels, and round pulleys fixed to the floor of the building. As each of these endless ropes is 8.28 met. long, the building took upwards of 100,000 met. (sixty miles) of rope, when it was originally constructed. The salt water is raised to the top of the building by an endless chain of buckets.

The salt water is first passed twice through two common graduating houses, with faggots, and then the two portions being united together, the liquid is passed seven times, or even oftener, through the third, from whence they pass to the fourth. The remainder of the process differs according to the weather.

During the fine season, which lasts three or four months, the liquid is passed from the fourth house to the boilers, and from thence when it boils to the rope graduating house, where it is repeatedly raised, until the greater part of the salt is deposited upon the ropes, which in very fine weather takes from twelve to sixteen hours. In general twenty-seven boilings take forty-five days.

The cords are then coated with common salt, so as to be sometimes 0.06 (2.3 in.) in diameter; this salt is got off by a cross piece of wood, armed with iron plates, being raised to the top of the building, and the cords pulled alternately, so as to strike the salt

against the plates. In the bad season the water is slowly evaporated in the boilers, of which there are four, all of the same size; they are from between seven and eight metres long, five and six broad, and 0.5 met. (19.6 in.) deep.

Yours, &c.

Oct. 21, 1831. H. B. Andrews.

[*Mech. Mag.*

Œnometer, or Alcohometer. By M. Emile Tabarie.

This instrument is intended to supply the manufacturer with the means of ascertaining the quantity of spirit in any vinous liquid. The principle consists in boiling the wine, for instance, in the open air, allowing the alcohol to escape, and making up the bulk of the residue by the addition of pure water. The difference between the density of this mixture and the original liquid indicates the quantity of alcohol which was present. The apparatus consists of a small boiler heated by a spirit lamp; a horizontal cross bar near the bottom, when left uncovered by the liquid, indicates when the ebullition has proceeded so far as to insure dissipation of all the alcohol. The densities before and after ebullition are ascertained by a hydrometer with a double scale. For correction of temperature, a thermometer with double scale is used, one scale being the centigrade, and the other a peculiar division, intended to simplify the operation. Tables accompany the instrument. The whole is intended for the distillers of the centre of France, and costs about forty francs.

[*Ann. de Chimie, xlv.* 222.

Engraving in Stereotype.

A substitute for wood engraving has lately been devised by a young artist, which, if half the sanguine expectations of its inventor should ever be realized, will totally supersede the present method. The process, the idea of which has evidently been taken from the stereotyping of letterpress, is, as far as hitherto developed, as follows:—A smooth and level plate of metal is covered with a thickness equal to that of the projecting part of type of any ductile composition which will bear heat; what the inventor proposes to use he does not divulge, but it is believed that many sorts of potter's clay will answer the purpose. While this is in a soft state, the design is, as it were, etched with a sharp instrument, care being taken that every line shall penetrate through the layer of composition to the surface of the plate. The great advantages here are, that the engraver has a much more easily worked material than boxwood to operate upon; that the design is cut *into* the material, as in copper-plate engraving, instead of having to be left in high relief, which is an elaborate and dilatory process; and that it is executed without the necessity of *reversing the design*, a point of great importance, especially where letters and inscriptions are required; these, of course, had always to be

cut the backward way; by this method they are cut just the same way as they are to appear finally upon the paper. When this portion of the process is finished, all that remains is to harden the composition, and take off a plate, or any number of plates, in stereotype metal, in the same way as if it were the plaster impression from a page of letter-press. These, of course, are to be printed from in the usual manner. Should the project succeed, the cost of engravings of the kind will be very greatly reduced. [*Mech. Mag.*

On a new Anemometer.—By Hugh Hamell.

To the Editors of the Philosophical Magazine and Annals.

Gentlemen,

Mr. Stevenson in his account of the erection of the Bell Rock light-house observes, "We cannot enough regret the want of an efficient anemometer, or instrument for measuring the force of the wind; indeed we hardly know any desideratum of more universal interest." It does not appear that this is yet supplied: and when we consider the many very eminent men who have directed their attention to this subject, and find nevertheless that they have not succeeded in producing an instrument at once ready, accurate, and sensible, it must be concluded that considerable difficulty lies in the way. And though I will not presume to say that I have completely overcome it, yet it appears to me that the instrument which I now propose possesses advantages over any other anemometer that I have seen or read of.

Before describing the instrument, I wish to observe that all the anemometers I am acquainted with are founded on one or other of these two principles: the deflection of a pendulous weight, or of a falling body, from the perpendicular; or the difference in elevation between the two columns of fluid in an inverted siphon. Of this last kind, the differential barometer of the late Dr. Wollaston, surpasses in sensibility to an indefinite degree, all others of the kind,—an invention worthy of the accurate and comprehensive mind of that lamented philosopher; but it is to be apprehended that in many cases it cannot be easily applied to practice.* It is the other principle, that of a pendulous weight deflected, that I make use of; and I shall now proceed to the description of the instrument I propose.

Imagine two pieces, which I shall call bars, like the two ruler pieces of the common parallel rule, and attached to each other by two joints in a similar manner; the joints being constructed so as to play with scarcely any friction. Let these bars be placed, in contact, with the plane of the joints perpendicular to the horizon; it is clear that the weight of the lower bar will cause it to separate from the upper; and the joints to arrange themselves perpendicular to the horizon. To one end of the lower bar (that end which is to be pre-

* A notice of Dr. Wollaston's paper on his Differential Barometer, will be found in this Journal, p. 349, vol. iv.

sented to the wind,) let a plane of given magnitude be affixed, perpendicular to that bar. Now, to use the instrument, let this plane be placed perpendicular to the wind, the upper bar being in a fixed position; the two bars being separated to their greatest distance, and the joints of course at right angles to the bars, and perpendicular to the horizon. The impulse of the wind acts as a force on the plane, and causes it to recede; but in consequence of the two connecting links, and the two parallel bars, it must still preserve its parallelism to its first position, while it will continue to recede; the links turning round their centres until they have reached such an angle from the perpendicular as shall produce an equilibrium between the impulse of the wind on the plane and the weight of the lower bar with its appendages, now supported by the links in an oblique position; the angle by which the links deviate from the perpendicular to be measured on a circular arc attached to the fixed bar. As the lower bar, plane, and links ought to be made as light as is consistent with the required strength, and further, perhaps, their common centre of gravity to be brought by counterpoise into the line joining the upper centres of the links, it will be seen that the most moderate breeze will cause the two bars to collapse, or nearly so. There must, therefore, be a series of weights, one or more of which must be suspended to the lower bar according to the strength of the wind, so as to cause the equilibrium to take place with the links at an angle not greater than 45°, from their quiescent or perpendicular position.

Now the weight deflected is known, the surface of the plane is known, and also the angle passed through by the links; hence, by an easy calculation, the force acting on the surface of the plane is readily deduced; and from this the velocity of the wind, by means of the tables published of the relation between that and the force.

I hope I have made my ideas sufficiently clear without encumbering your valuable pages with a sketch, or with the details of construction. And for the same reason I shall not make any comparisons between this and other anemometers, except that I conceive the suspended sphere, as it always presents an equal and similar surface to the wind, makes a very simple anemometer, and by counterpoising as I have done, it might be rendered sensible to almost any degree; but I think it is liable to objections, from which I believe that which I propose to be free.

I shall feel obliged if you will give insertion to this paper in your extensively read and valuable journal; my object being to assist in attaining that desideratum which would be of such advantage in many cases of practical mechanics, as well as in meteorological observations.

I am, gentlemen, your obedient servant,

Dublin, Oct. 28, 1881. HUGH HAMELL.

[*Phil. Mag.*

Indian Arts and Manufactures.

No. II.*

The Palm or Toddy Tree.

The most extensively useful tree in India, and probably in the world, is the palm tree. In India I have only observed four species. 1st. the *cocos nucifera*, or cocoa-nut tree, which is common all along the western coast, near the sea, as far north as Surat—some are found even more to the northward. 2ndly. the *bonassus flabelliformis*, which the natives call the "tar," is also in great numbers as far up as Cutch; I have myself seen it 130 miles from the sea; but I believe it is to be found at a much greater distance. 3dly. the *phœnix dactylifera*, or date palm, is common all the way up the coast from Cape Cormorin to Cutch, and is found several miles inland. 4thly. the *areca*, which is cultivated only on account of the nut, is found in gardens in Bombay, Baroda, &c. &c.

Every part of the cocoa-nut tree is used for some purpose or other. The nut is well known, and is not only an indispensable ingredient in every article of native cookery, curries, pilaws, &c.: but yields by expression (when dried,) an oil which is superior to linseed oil for burning, both as having less smell, and producing in the combustion no visible smoke. The natives also anoint themseves all over with it. The shells of the cocoa-nut, when burnt to charcoal and pounded, are used in paint, like lamp-black in England. The hard, or inner shell of the nut, forms their drinking cups, as well as a material part of their smoaking apparatus: half full of water, with two hollow bamboos fitted into as many holes bored in it, and an earthen "chilum" at the top full of tobacco, it forms their "hukka," a companion which no native would willingly be without. The outer shell consists of a stringy substance called "coir," pronounced "kyar." It is equal to horse hair for stuffing mattresses, pillows, &c., and when formed into ropes is in some respects equal, and in others superior to hempen cordage, being much lighter, more elastic, and not so likely to be damaged by wet. The leaves of this, as well as of the "tar" tree, when dried and platted, are called "cajan," and are used for laying under the thatch of houses, by which a much smaller quantity of grass will suffice. They are sometimes used without grass, but then require to be renewed annually. The body of the tree is of much service, when hollowed out, as a course to conduct water across a road, or "nulla" (the dry bed of a rivulet, or mountain torrent,) for the purpose of irrigating lands at a distance from the well, or tank, from whence the water is drawn. But to the owner of the property the most valuable part of the palm tree is the toddy. The best and sweetest is extracted from the date palm; the cocoa-nut tree yields the next best, which,

* The great distance of the writer of these valuable papers from England, will account for his communications being so "far between." No. 1 appeared in our 14th vol. p. 387. We need not say that an early continuation of the series will be most acceptable.—*Editor Mech. Mag.*

however, as well as that obtained from the "tar," or fan-leaf palm, (as I believe it is called,) is more abundant than the former; it is never taken from the areca. This liquor is thus obtained. At sunset, a man of the Bundarree caste of Hindoos mounts the tree with two or three earthen pots, called "chatty," capable of containing about a gallon each, tied to his waist, and a large knife, shaped like a sickle, in his hand. He is assisted in his mounting by two circular pieces of rope, large enough to extend round (when doubled) two-thirds of the circumference of the tree, one of them being attached to his hand, and the other to his feet, by which means he ascends the tree without the assistance of his knees. Some of these trees, I should guess, are above 100 feet in height; and one man has twice daily to ascend and descend some fourteen or fifteen, or even more of them. He cuts off one of the leaves of the tree when the stalk is about two inches in diameter, and ties on one of these chatty pots. If the leaf has before been cut off for the extraction of the toddy, he only removes half an inch from the end of the stalk, whence the toddy again exudes. After having thus fixed his pots, sometimes three or four on one tree, he descends the tree, and mounts as many more as may be necessary. In the morning, at daybreak, he returns to the trees, takes down the pots, which are half full of liquor, and places others in their stead. This liquor, which, when fresh from the tree, is called "neera," is as transparent as water, and of a pleasant, sweet taste; but immediately the sun rises, it begins to ferment, after which it becomes of a milky colour, tart, and sourish—it is then termed "taree," whence our corruption, toddy. The fermentation is soon at its height, and in that state it is used by our bakers as a substitute for yest to raise the dough. A great deal of the taree is drank by natives, and is of an intoxicating quality; but by far the greater portion is made into vinegar, or distilled into arrack. The European soldiers, and even warrant officers, who are used to it, prefer arrack to brandy or rum, though it is not relished by Europeans on their first arrival. Besides arrack, there is another species of distilled liquor, called "mowrah," which is made from the flowers of a tree of the same name, which grows to about the size of a beech tree. As I have not had an opportunity of examining it, I do not know to what class it belongs, or what its English or Linnæan name may be. The flowers, when dried, have much the appearance of a fig, but are only about the size of a raisin; and their taste is somewhat like the latter, with a bitter flavour exactly like hops; and I have no doubt that when we shall have proceeded to so high a degree of refinement in this country as to brew our own "Hodgson," that they will fully answer every purpose of the latter.

BENGEIN.

Goozerat, *Oct.* 28, 1830.

[*Mech. Mag.*

On the Discharge of a Jet of Water under Mercury. By R. W. Fox, Esq.

Having observed that a communication of mine "on the discharge of a jet of water under water," inserted in No. 47 of the Philosophical Magazine, has been noticed in the last number of the Journal of the Royal Institution,* I will take this opportunity of mentioning, that where a jet of water is discharged under mercury, the results are the same, under a given force, as when it takes place in water, or air, the quantity discharged being in all cases the same, in the same time.

Hence, it appears that the force with which a moving or spouting fluid recoils is not affected by the surrounding medium, however rare or dense it may be: and thus we may understand why the attempts which have been made to propel vessels by forcing water through them against water, have not proved advantageous.

The well known fact that large rivers penetrate, in a direct course, far into the ocean, notwithstanding its agitation by tides and currents, is somewhat analogous; and were it not for this remarkable degree of mobility in water, the sediment, which is now mostly deposited at a considerable distance in the sea, would accumulate near the mouths of rivers, and tend to divert them from their course.

Whilst making my experiments on the jet of water, I noticed that when sand was dropped into the water near the orifice from which the jet issued, it was drawn laterally toward the hole, till it distinctly appeared to enter it, but it was in fact only an optical deception, the grains of sand being carried away by the jet as soon as they came in contact with it, with such great velocity as to be perfectly invisible. [*Jour. Roy. Inst.*

Tanning of Leather by Grape Marc.

A medical man of the neighbourhood of Narbonne has announced that the marc of grapes, after being distilled for the purpose of separating the alcohol, is an important assistant to oak bark, in the tanning process. After preparing skins in the usual manner, he placed them in the pits with the marc, in the place of bark. In thirty-five or forty days the tanning was finished. The expected advantages are, 1, shorter time; 2, reduction of the price of oak bark; 3, a more agreeable odour of the leather than that given by oak bark; 4, greater strength in the leather. [*Recueil Industrielle.*

Planting Potatoes whole.

A correspondent of the Gardener's Magazine, No. xxxv. for December, writing upon the above question, agrees with Mr. T. A. Knight in recommending that they should be planted whole: and adds, "as a testimony, I will state an experiment of mine in 1828. I planted four plants containing two eyes to each; four, the crowns

* See vol. viii. p. 69, of this Journal.

containing perhaps five or six eyes each; four small whole potatoes, (what are here termed chats;) four large whole ones, (or what are termed ware potatoes.) Now for the weight of the produce of each kind: the produce of the first four roots weighed eight pounds; that of the second four, eleven pounds; that of the third four, fifteen pounds; that of the fourth four, sixteen pounds. I think this will make clear to any one, that the reverse of what is generally followed ought to be practised; namely, to plant crowns or whole potatoes in lieu of a plant with two eyes. This is even the second trial I have made, and found it the same; but I was not so particular in the first experiment as in the second, having determined by my eye, the difference was so obvious. I think this of the greatest importance to the agriculturist. If it hold good for an acre, what a difference in the produce! The object of a little extra seed bears no comparison to the extra produce; and besides, the labour of cutting is saved.

[*Rep. Pat. Inv.*

Pure Oil for Chronometers.

Put about one gallon of good olive oil into a cast iron vessel capable of holding two gallons; place it for one hour over a slow clear fire, keeping a thermometer suspended in it; and when the temperature rises to 220° check the heat, never allowing it to exceed 230°, nor descend below 212°; at the end of the hour the whole of the water and acetic acid will be evaporated. The oil is then to be exposed to a temperature of 30° to 36° for two or three days, till a considerable portion of it is congealed, and while in this state the whole is to be poured on a muslin filter, to allow the fluid portion to run through. This fluid portion is then to be filtered once, or oftener, through newly prepared animal charcoal, grossly powdered, or rather broken, and placed on bibulous paper, in a wire frame, within a funnel; by this operation any rancidity that is present will be entirely removed, and the oil rendered perfectly bright and colourless. This process has been employed for several years with great success by Mr. Henry Wilkinson, of Pall Mall, and Messrs. Baraud and Sons, of Cornhill, who both agree in representing it as superior to every other mode of purification hitherto known. Mr. Wilkinson states that he does "not think it possible to render oil purer or better qualified for the required purposes, as no extraneous substance is introduced which can in the slightest degree injure its quality."

[*Mech. Mag.*

¶ *On the Detection of the Traces of Writing Fraudulently Effaced.*

Professor Gazziri, of Florence, having been frequently appointed by the tribunals to give professional evidence on trials of this nature instituted experiments on the subject, which, by showing him the possibility of removing not only the ink, but also the materials employed in its removal, proving that cases might arise when the fraud

could not be detected in any other manner than by examining the condition of the paper or other materials written upon. For this purpose optical means were tried in vain, and immersion in water did not show such a difference in the absorptive power of the written and unwritten parts, as happen in the employment of certain sympathetic inks; but on exposure of the suspected paper to a moderate fire, the paper, which in consequence of the corrosive effects of the ink, was in those parts altered in its nature, was unequally acted on by the process of carbonization, and thus the number and length of the lines, and often the whole of the erased portion, were distinctly revealed. [*First Report of British Asso. for Advanc. of Science.*

Meteorological Observations for June, 1832.

Moon.	Days.	Therm. Sun rise	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches.				Inches.	
	1	52°	73°	29.70	29.75	45	NW.	Moderate.		Clear day.
	2	50	80	.73	.65	49	NE. W.	do.	.26	Clear day.
	3	56	54	.50	.45	62	E.	do.		Cloudy—rain.
	4	48	59	.50	.60	53	E. S.	do.	.35	Cloudy day.
☽	5	49	52	.60	.65	54	SE.	do.		Rain.
	6	48	68	.70	.70	53	W.	do.	.04	Lightly cl'dy: flying cl'ds.
	7	54	69	.70	.75	55	W. E.	do.		Cloudy—light shower.
	8	50	74	.75	.80	57	E. SE.	do.	.03	Fog—clear.
	9	51	74	.90	.90	56	NE. SW.	do.		Foggy: clear: shower n't.
	10	56	78	.90	.90	60	SW.	do.		Cloudy—flying clouds.
	11	60	89	.90	.90	66	SE. W.	Breeze.		Fog—clear.
	12	70	80	30.00	30.00	65	S.	do.		Clear day.
☺	13	58	81	.00	29.90	63	E. S.	Calm.		Cloudy—clear.
	14	67	81	29.80	.70	65	SW.	Breeze.	.08	Fog—clear.
	15	67	92	.76	.76	73	W.	do.		Fog: cl'dy: thund. sh'w'r.
	16	68	90	.70	.70	67	W. SW.	do.		Fog—clear.
	17	74	89	.70	.70	64	WNW.W.	do.	.20	Hazy—clear.
	18	72	90	.70	.83	73	W.	Blustering.		Light cl'ds: thund. sh'wr.
	19	68	68	.60	.80	49	W.	Breeze.		Flying clouds.
	20	51	77	30.05	30.10	42	W.	do.		Clear day.
☾	21	58	84	.10	.20	49	W.	do.		Clear day.
	22	60	84	.14	.10	59	W.	do.		Clear day.
	23	59	86	29.94	29.94	51	W.	do.		Light clouds—clear.
	24	63	89	.94	30.00	55	W.	Calm.		Clear day. [realis.
	25	63	88	.94	29.94	58	SW.	do.		Clear day: Aurora Bo-
	26	64	90	.94	.90	62	SW.	Breeze.		Light cl'ds—flying. cl'ds.
⊗	27	71	89	.70	.70	67	S.	do.		Cloudy day.
	28	68	86	.70	.75	63	W.	do.	.04	Light rain—flying clouds.
	29	57	83	30.00	30.10	47	NW.	do.		Clear day.
	30	61	83	.10	.10	55	SW.	do.		Clear day.
	Mean	59.77	79.33	29.82	29.83	58			1.00	

		Thermometer.	Barometer.
Maximum height during the month,		92. on 15th.	30.20 on 21st.
Minimum	do. . .	48. on 4th & 6th.	29.50 on 3d and 4th.
Mean	do. . .	60.55 . .	29.82

# JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

SEPTEMBER, 1832.

On the invention and progress of Medal ruling in the United States. By the Committee on Publications.

(WITH A COPPERPLATE.)

During the time when communication, even between neighbouring nations, was not common, similar inventions were frequently made independently in several different countries and at different times: hence, in the progress of information, perpetual disputes arose as to originality, or priority, and much crimination and bitter feeling were produced.

America *has been* without her journals to put forth the claims of her ingenious men, and the credit of more than one invention has passed from her to those who have been able to give greater publicity to their designs; but this day has passed away, and we find notices of the ingenious works of our countrymen transferred to the pages of foreign journals to be appreciated and acknowledged abroad as well as at home.

We propose briefly to set before our readers a correct history of the invention of a *machine for straight and waved line ruling, and for medal ruling*, which the impressions conveyed by the following paragraphs appear to render necessary.

Extract from the proceedings of the Friday evening meetings of the Royal Institution of Great Britain, as given in the Philosophical Magazine and Annals of Philosophy, for April, 1832.

"*February* 3d.

"Afterwards the beautiful machine constructed by Mr. Bate, of the Poultry, for producing engravings of medals by machinery applied to the surface of the medal itself, or to that of the cast from it, was shown and explained by Mr. Faraday. Drawings would be required to make the description intelligible here. A plate was partly engraved, and many impressions from other plates were shown. Mr. Bate is still engaged in perfecting this instrument."

We are not told who *invented* this machine, but Mr. Bate's claims appear more distinctly in the terms of a patent which he has taken out.

"John Bate, of the Poultry, optician, for an improvement or improvements on machinery applicable to the imitation of medals, sculpture, and other works of art, executed in relief; six months: April 9."—(*Mechanics' Mag.*)

Believing that the credit of the invention of a machine for medal ruling is due to America, we will briefly set forth our proofs, and then speak of the improvements which of late years the method has undergone.

The proofs to be given of the existence and state of a machine are to be derived from the results produced by it.

In 1817, by the use of a machine which had been invented in Philadelphia, Christian Gobrecht, die sinker, produced upon copper an engraving from a medal, having upon it the head of Alexander of Russia: from this engraving impressions were taken and distributed. One of these impressions we have seen.

In 1819 Asa Spencer, (now of the firm of Draper, Underwood & Co., bank note engravers,) took with him to London a machine of the kind above alluded to, which was designed principally for straight and waved line ruling. This machine was used in London during the year just mentioned, and the mode of ruling waved lines, and of *copying medals*, was then exhibited and explained by Mr. Spencer to several artists; particularly to Mr. Turrell, who took, by permission, a drawing of the machine, for the purpose of having one made for his own use.

Little, however, was done in the way of medal ruling until about three years since, when a desire to apply the method to the engraving of designs for bank notes caused it to be revived by Mr. Spencer, who bestowed great attention upon it, and overcame the difficulties met with in the outset.

The peculiar construction of this machine has never been made a secret, nor has it ever been patented, although prudential motives have required that it should not be minutely described, and thus be placed in the hands of those by whom its use might be perverted. In consequence of this free communication in relation to this machine, it is now made, with modifications in the details, for engravers, by some of our machinists. We have lately had the pleasure of inspecting one of beautiful workmanship, made by Messrs. Tyler, Fletcher & Co.

The operations performed by this machine are the ruling of parallel straight lines at any required distances apart, and either continuous

or broken; ruling converging straight lines; ruling waved lines, the waves being either similar or varying by more or less imperceptible gradations; and medal ruling, or transferring to copper the fac-simile of a medal without injuring its surface, the waved lines presenting a copy of the minutest parts of the medal.

Mr. Bate is said, in the extract which we have given, to be engaged in *perfecting* a machine for medal ruling: in his patent he claims the improvements on a machine for that purpose. It is impossible to say how far this latter claim may be borne out, since a description of the patented improvements has not yet reached us.

That Mr. Spencer has essentially *perfected* this machine as far as beauty of execution, and fidelity of representation in the work to be done by it are concerned, we do not hesitate to say, and that the public here, and our brethren of England, may be enabled to judge for themselves, we have obtained from Mr. Spencer a specimen* of medal ruling executed with his machine, an impression from which we give.

The engraving is made from a copper medal placed in an embossed card of the ordinary kind. The surface of the medal bears not the slightest trace of injury from the machine, and even the yielding surface of the card is not roughened by it.

An impression taken thus from a plate gives but a faint idea of the exquisite effect produced by engravings themselves made by this machine upon a polished surface of gold or silver.

A series of the Napoleon medals, together with a portion of the series of medals struck in commemoration of the events of the first French revolution attest the skill of Mr. Spencer.

If even claims to improvement upon this machine should be established, we trust that what has been here advanced in relation to the invention and progress of medal ruling in this country, will neither be overlooked nor forgotten.

A. D. B.

Description of an apparatus used as a substitute for the Lewis in raising heavy stones. By Wm. Howard, *Civil Engineer.*

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Dear Sir,—I send you the description of a hook or lever for raising stone, which I have found very useful for the particular purpose for which it was intended. It is, I believe, new; but it is very possible that your intimate knowledge of whatever has been done in the way of mechanical contrivances, may convict it of being a "modern antique." If *you* cannot find its prototype, I think I may safely lay claim to it as an original invention: and in that case I would thank you to insert this description in your valuable journal, with a hope that it may be found to be of use in other cases similar to that in which I have employed it.

Yours, respectfully,

Baltimore, July 31*st*, 1832. Wm. Howard.

* Various specimens of this work have been long since sent to London, and may be found in the possession of Messrs. Perkins and Heath, and of other artists.

DESCRIPTION.

The M'Kim school, now erecting in Baltimore by the liberality and taste of a public spirited individual, is to be an exact copy, as to the portico, of the celebrated temple of Theseus at Athens, and of the precise size of the original. The body of the building is composed of blocks of granite ashler, from Ellicott's mills, each course being of the same height. To permit these blocks to be placed with accuracy and convenience, it was necessary to suspend each one in such manner as to leave its bed and sides entirely free. The Lewis with two pins, represented in fig. 1, and similar to one described in Rondelet, *Art de Batir* was tried, and found to succeed very well, requiring only two holes to be bored about three inches deep, which can be done in the granite with great facility. Still it was desirable to avoid the labour of fitting this Lewis to more than 400 blocks, and the contrivance represented by fig. 2, was invented for the purpose, and has been found to answer perfectly.

It consists of an iron bar, bent in the form A B C D, and of a size proportionate to the blocks of ashler intended to be raised. At C a mortise is made through it, admitting freely the bar H E. This bar is pierced with holes, as shown in the figure, through one of which an iron pin is put, to prevent it from slipping towards H. At F is a plate attached to this bar, between which and the ashler block G, a piece of wood is placed to keep the iron from injuring the worked face of the block. The end D forms a steel pin, which may be inserted about an inch into a hole bored in the block; but in cases where the least projection or shoulder can be found for this point to catch hold of, this labour of boring is not necessary; the smallest prominence being sufficient to give the instrument a perfectly firm hold, or gripe, of the stone, which becomes still firmer as the weight comes to bear on it.

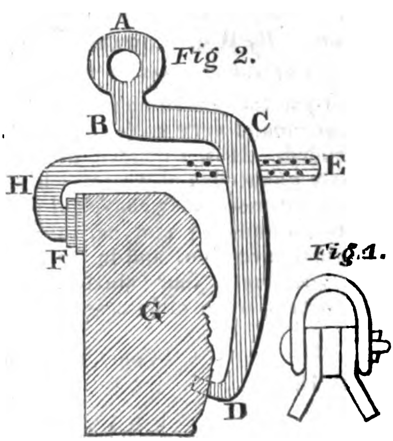


Fig 2.

Fig. 1.

Remarks on the Strength of Cylindrical Steam Boilers. By Prof. Walter R. Johnson, *of the Franklin Institute.*

[Read before the Institute at the stated Monthly Meeting, July 26, 1832.]

It has been generally supposed that the rolling of *boiler-plate* iron, gives to the sheets a greater tenacity in the direction of the length, than in that of the breadth. Supposing this to be correct, it has frequently been asked how the sheets ought to be disposed in a cylindrical boiler of the common form, in order to oppose the greatest strength to the greatest strain. It has also been asked whether the same arrangement will be required for all diameters, or whether a magnitude will not be eventually attained, which may require the direction of the sheets to be reversed?

To determine these questions in a general manner recourse must be had to mathematical formulas, assuming such symbols for each of the elements as may apply to any given case of which the separate data are determined either by experiment or by the conditions of the case. The *principles* of the calculation require our first notice.

1. To know the force which tends to burst a cylindrical vessel in the longitudinal direction, or, in other words, to separate the *head* from the curved *sides*, we have only to consider the actual area of the head, and to multiply the number of units of *surface* by the number of units of *force* applied to each superficial unit. This will give the total *divellent* force in that direction.

To counteract this, we have, or may be conceived to have, the tenacity of as many longitudinal bars as there are lineal units in the circumference of the cylinder. The united strength of these bars constitutes the total retaining or *quiescent* force, and at the moment when rupture is about to take place, the *divellent* and the *quiescent* forces must obviously be equal.

2. To ascertain the amount of force which tends to rupture the cylinder along the curved side, or rather along two opposite sides, we may regard the pressure as applied through the whole breadth of the cylinder upon each lineal unit of the diameter. Hence the total amount of force which would tend to divide the cylinder in halves by separating it along two lines, on opposite sides, would be represented by multiplying the diameter by the force exerted on each unit of surface, and this product by the length of the cylinder. But even without regarding the length, we may consider the force requisite to rupture a *single band* in the direction now supposed, and of one lineal unit in breadth; since it obviously makes no difference whether the cylinder be long or short in respect to the ease or difficulty of separating the sides. The *divellent* force in this direction is, therefore, truly represented by the diameter multiplied by the pressure per *unit of surface.* The retaining, or *quiescent* force, in the same direction, is only the strength or tenacity of the two opposite sides of the supposed band. Here also at the moment when a rupture is about to occur, the *divellent* must exactly equal the *quiescent* force.

3. In order to estimate the augmentation of *divellent* force conse-

quent upon an increase of diameter, we have only to consider that as the diameter is increased the product *of the diameter, and the force per unit of surface*, is increased in the same ratio. But unless the thickness of the metal be increased, the *quiescent* force must remain unaltered. The *quiescent* forces, therefore, continue the same—the *divellent* increase with the diameter.

4. Again, as the diameter of the cylinder is increased, the area of its end is increased in the ratio of the *square* of the diameter. The *divellent* force is therefore augmented in this ratio. But the retaining force does not, as in the other direction, remain the same, since the *circumference* of a circle increases in the same ratio as the diameter. The *quiescent* force will consequently be augmented in the simple ratio of the diameter, without any additional thickness of metal. So that on the whole, the total tendency to rupture in this direction will increase only in the *simple* ratio of the diameter.

5. Since we have seen that the tendency to rupture, in both directions, increases in the simple direct ratio of the increase of diameter, it is obvious that any position of the sheets which is right for one diameter, must be right for all. Hence there can never be a condition, in regard to mere magnitude, which will require the sheets to be reversed.

6. The foregoing considerations being once admitted, we may proceed to ascertain what is the true direction of the greatest tenacity in the sheet, if any difference exist, and what that difference might amount to, consistently with equal safety of the boiler in both directions.

7. Let $x =$ the diameter of the cylinder.

$f =$ the force or pressure per unit of surface, (pounds per square inch, for example.)

T = the tenacity of metal which, with the diameter x and the force f, will be required in the lineal unit of the circumference in order to hold on the head.

Then will the whole *quiescent* force be $3.1416\,x\,\mathrm{T}$, while the *divellent* will be $.7854\,x^2 f$; consequently $.7854\,x^2 f = 3.1416x$ as above stated.

Dividing by $.7854\,x$ we have $xf = 4\mathrm{T}$; and we derive immediately—

$$x = \frac{4\mathrm{T}}{f}$$

$$f = \frac{4\mathrm{T}}{x}$$

$$\text{and} \quad \mathrm{T} = \frac{xf}{4}$$

That is, the tenacity of the *longitudinal bar of the assumed unit in width, will be one-fourth of the product of the diameter into the pressure*, measuring the tenacity by the same standard as the pressure, whether in pounds or kilograms.

8. Now assuming the tenacity required in the *circular band* of the same width to be t, we shall, agreeably to what has already been said,

have the *divellent* force expressed by xf, and the *quiescent* by $2t$, so that $xf = 2t$ and $t = \frac{xf}{2}$. Also $f = \frac{2t}{x}$; and $x = \frac{2t}{f}$.

Having thus obtained two expressions for each of the quantities x and f, we may, by comparing them, readily discover the relative values of T and t,—thus,

$$\left.\begin{array}{l} x = \frac{4T}{f} \\ x = \frac{2t}{f} \end{array}\right\} \text{hence } \frac{4T}{f} = \frac{2t}{f} \text{ whence } 4T = 2t, \text{ or } t = 2T.$$ From which it follows, that *under a known diameter, and with a given force or pressure, the tenacity of metal in a cylindrical boiler of uniform thickness, ought to be twice as great in the direction of the curve as in that of the length of the cylinder, and that if this could be the case the boiler would still have equal safety in both directions.*

In whatever direction, therefore, the rolling of metal gives the greatest tenacity, in the same direction must the sheet always be bent in forming the convexity of the cylinder. It follows that if we suppose the tenacity precisely equal in both directions, the liability to rupture by a mere internal pressure, *ought to be twice as great along the longitudinal direction as at the juncture of the head.* This supposes the strain regular, and the rivetting not to weaken the sheet.

9. To know how large we may safely make a cylindrical boiler, having the absolute tenacity of the metal, in the *strongest direction*, and with a known thickness, we have only to revert to the formula $x = \frac{2t}{f}$. That is, *the diameter will be found by dividing twice the tenacity by the greatest force per unit of surface, which the boiler is ever to sustain.*

10. When knowing the absolute tenacity of a metal, or other material reckoned in weight, to the bar of a given area in its cross section, we would determine the *thickness* of that metal which ought to be employed in a boiler of given diameter, and to sustain a certain force, we may use the formula $t = \frac{xf}{2}$, and dividing the latter number of this equation by the *strength* of the square bar, which we may call s, we obtain the thickness demanded in the direction of the curve, which we may denominate p; so that $p = \frac{xf}{2s}$; this will give the thickness of the boiler plate either in whole numbers or decimals. Thus, suppose the diameter of a cylindrical boiler is to be thirty-six inches—that it is to be formed of iron which will bear 55000 lbs. to the square inch, and is to sustain 750 lbs. to the square inch,—what ought to be the thickness of the metal?

$$\begin{aligned} \text{Here } x &= 36 \\ f &= 750 \\ 2s &= 110000, \text{ consequently,} \end{aligned}$$

$p = \frac{36 \times 750}{110000} = .2454$, or a little less than one-quarter of an inch.

It must, however, be evident that the *minimum* tenacity of any particular description of metal, is that on which all the calculations ought to be made when there is any probability that the actual pressure will, in practice, ever reach the limit assigned as the value of f in the calculation.

If we had plates of different metals, or of different known degrees of tenacity in the same kind of metal, and were desirous of ascertaining how strong a kind we must employ under a limited *thickness*, *diameter* and *pressure*, we should decide the point by transforming the formula $p = \frac{xf}{2s}$, into $ps = \frac{xf}{2}$, and then into $s = \frac{xf}{2p}$. In other terms, in order to know the strength of the metal required, or the direct strain which an inch square bar of the same ought to be capable of sustaining, we must *multiply the diameter of the boiler in inches by the pressure per square inch in pounds, and divide the product by twice the intended thickness in parts of an inch.*

Thus, how strong a metal ought to be employed to sustain a pressure of 1000 lbs. to the square inch, in a boiler thirty inches in diameter, and one-fourth of an inch thick?

Here $s = \frac{30 \times 1000}{2 \times .25} = 60.000$. Hence we see that the metal must be capable of sustaining *sixty thousand pounds* to the inch bar, or in that proportion for any other size. This formula enables us to determine whether among the metals of known tenacity, *any* one can be found to fulfil the conditions under the thickness assigned.

On the basis of the foregoing formulas the following table of diameters, thicknesses of iron, and strains to the inch of metal, in both directions, has been formed.

It is obvious that the *actual* tenacity of the metal employed in a given case must be of the greatest importance to the result. The extensive series of experiments recently undertaken by the Institute to determine this question in reference to different kinds and varieties of boiler plate, and with regard to the various circumstances of its manufacture and application, will hereafter furnish us with important data to aid in applying the formulas to each separate case. I shall for the present assume the tenacity of an inch square bar of rolled iron at 55,000 pounds, in the direction of the length of the sheet. Supposing the pressure generally employed in cylindrical high pressure boilers to be 150 lbs. to the square inch, agreeably to the practice in this city, the table is calculated upon the principle that the boiler ought to have five times as great a strength as it is ordinarily required to exert. The calculation is upon a continuous sheet of metal without seams in any direction. The thicknesses are given in ten-thousandths of an inch; but in practice the last figure may be omitted without material error.

Diameter of the boiler in inches.	Thickness of plate iron which will bear 55,000 lbs. to the square inch required to resist the strain in the direction of the curve under a pressure of 750 lbs. to the square inch—calculated by the formula $p = \frac{xf}{2s}$.	Corresponding tenacity of each inch wide ring or band, required to support a pressure of 750 lbs. to the square inch, calculated on the formula $t = \frac{xf}{2}$.	Tenacity required in each longitudinal bar of one inch wide to sustain the pressure tending to burst out the head, calculated on the formula $T = \frac{xf}{4}$.
Inches.	Inches.	Pounds.	Pounds.
1	.0068	375	187.5
2	.0136	750	375
3	.0204	1125	562.5
4	.0272	1500	750
5	.0341	1875	937.5
6	.0409	2250	1125
7	.0476	2625	1312.5
8	.0545	3000	1500
9	.0613	3375	1687.5
10	.0681	3750	1875
11	.0745	4125	2062.5
12	.0818	4500	2250
14	.0954	5250	2625
16	.1090	6000	3000
18	.1227	6750	3375
20	.1363	7500	3750
22	.1490	8250	4125
24	.1636	9000	4500
26	.1773	9750	4875
28	.1909	10500	5250
30	.2045	11250	5625
32	.2182	12000	6000
34	.2318	12750	6375
36	.2455	13500	6750
38	.2591	14250	7125
40	.2727	15000	7500
42	.2860	15750	7875
44	.2980	16500	8250
46	.3116	17250	8625
48	.3252	18000	9000
50	.3388	18750	9375

13. I am not aware that this subject has been previously treated in a general manner, at least as it regards several of the points above presented. Mr. Oliver Evans made some particular calculations of the strength requisite to sustain the pressure in a boiler of known dimensions, under a tension of 1500. lbs. to the square inch. In the table at page 27th of his "Young Steam Engineer's Guide," he has given calculations for seventeen different diameters of boilers, with the

power which, at each diameter, the steam would exert "to break every ring of one inch wide in any place," and "the thickness of the sheets of good iron necessary to hold the power." His table is formed on the supposition that sheet iron will bear 64,000 lbs. to the square inch, and would consequently lead to considerable *excesses* if strictly applied in practice. To six of the diameters he has annexed the "power exerted on the heads to burst them out in pounds weight." These he has calculated in the usual manner, by multiplying the area by the pressure per inch. Opposite to three of the numbers just mentioned, he has added "the strength of the boiler to hold the head on in pounds weight."

These he has calculated on the supposition that the metal had equal tenacity in all directions. On this supposition, and on the principles above developed, each of these three numbers should have been exactly double of that against which it stands in the preceding column. Neither of the three is so, precisely; but the first and third come as near it as could be expected, considering that the thickness is expressed only in 100ths of an inch; while the second is too small by more than a million of pounds.

These errors would not, I apprehend, have occurred, had the author adverted to the general principle above developed in regard to strength required of the metal in the two directions.

The following extract from the table just alluded to, will illustrate the preceding remarks. A column of corrected results has been added.

(See "Young Steam Engineer's Guide," p. 27.)

Diameter of the boiler in inches.	Power to break each ring of one inch; pressure being 1,500 lbs.	Thickness of the plate of iron of 64,000 lbs. to the sq. in.	Power exerted on the heads.	Strength to hold on the heads.	Corrected numbers to be substituted for those of column 5, agreeably to the foregoing remarks.
42	31.000	.48	2.077.500	4.052.400	4.155.000
36	27.000	.42	1.525.500	2.037.440	3.051.000
20	15.000	.23	471.000	918.777	942.000

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN MARCH, 1832.

With Remarks and Exemplifications, by the Editor.

1. For an *Apparatus for ventilating Vessels, and purifying and cooling the air of Steam-boats;* Jesse Remington, city of Baltimore, March 1.

To be ignorant of the nature and preparation of such an agent as chlorine, is no disgrace to a person whose pursuits have not been scientific; but for one so situated to pretend to have discovered new modes of applying it, manifests a degree of temerity which might well excite surprise were not events of a similar character so common; and that they are common is strikingly exemplified by our monthly analysis of the transactions of the patent office. The instance before us is an example of that utter failure which may well be anticipated when ignorance and temerity, such as we have spoken of, unite in an attempt at scientific investigations, and in a claim to scientific discovery.

It is proposed to make a metallic reservoir of one foot in diameter, and eighteen inches in height, with a screw cap to close it up; and this reservoir is to contain a solution of chloride of lime, or of chloride of soda. A force pump, the cylinder of which is to be a foot in length, and its diameter five inches, surmounts the reservoir, and by it atmospheric air is to be forced through a tube which dips into the solution: from the upper part of the reservoir, above the solution, copper tubes are to lead into the hold of the vessel. This constitutes the whole apparatus, and exhibits all the agents to be employed, unless we count the man who is to work the pump handle. But in what way are these to operate? The patentee says that the atmospheric air being forced by the pump through the chloride, is impregnated with it, and consequently he claims as his invention "impregnating air with chloride in the reservoir as before described; also in giving an agreeable odour to the air when purified by the same apparatus; or conveying pure atmospheric air by the same apparatus."

When air is thus forced into the hold of a ship, or other vessel, it is manifest that were the vessel perfectly air tight, and the operation persevered in *long enough*, she must explode; to avoid such a catastrophe, and to allow of the exit of the foul air, "openings are left in the deck around the mast, or in any convenient situation, for its escape."

When the patentee has informed us in what way the air becomes impregnated with *chloride*, he may next undertake to instruct us in the method of surmounting insurmountable difficulties, or of arriving at the bottom of the bottomless pit. The fact is that by the proposed process, the air of the atmosphere would acquire a slight odour of *chlorine;* and that, principally, in consequence of the action of the minute portion of carbonic acid contained in it, but its influence would be as that of a drop in the ocean. If the patentee had directed the

throwing of the dry chloride, or the pouring of its solution into the hold of the vessel, such direction would have been good, but then his patented apparatus would not have come into play.

The idea of purifying a ship's hold by forcing into it a gallon of atmospheric air at every stroke of a piston is too absurd to be entertained for a moment, yet even this is more rational than the proposed impregnation with *chloride*.

We have been induced to extend our notice of this *invention* to an unmerited length, and our reason for doing this is a knowledge of the fact that application has been made to the Navy Board to adopt this apparatus in the national marine. All we can say in its favour is that it is as harmless as it is useless.

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2. For a *Thrashing Machine;* Nathaniel Adams, Westmoreland, Oneida county, New York, March 2.

The beaters on the cylinder are to be of cast iron, and we are told what is about the proper length for the teeth, and the distance between them, and how they are to be fastened on to the cylinder. The concave is likewise to be cast, and with teeth on it formed by grooves, it is to be suspended on springs regulated by screws, &c. The claim is to these *peculiarities*, if such they are; but the host of thrashing machines is too great to admit of their being mustered and inspected to see whether their accoutrements may not differ in some minute point from that before us. Besides this, after we had taken all the trouble we could, we might fail to accord in opinion with the patentee, a sin we have committed in our last lucubration, and one which we will not repeat until we are compelled to do so.

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3. For *Boring or cutting out the ends of the Hubs of wheel carriages to receive the Boxes;* John B. Francis, Louden county, Virginia, March 2.

The hub to be bored is fixed within a sort of cage work composed of different pieces of iron adapted to the purpose of holding it centrically, and steadily, on a wooden frame. It is sustained upon this frame by making it the bearings for a cylindrical iron spindle which passes through the hub, and upon which it is capable of being turned round. For this purpose the spindle slides through holes in iron plates forming a part of what we have called the cage work, and into these holes the spindle fits accurately. By means of a mortise in the spindle, suitable cutters are fixed by wedging, or otherwise, which cutters are adapted in size and structure to the hole to be cut. When the respective parts are fixed in their proper places, the spindle is secured from turning round; the hub, or wheel, is then turned against the cutter, and the hole sunk to the proper depth.

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4. For a machine for *Hulling Clover Seed;* Christopher Seabold, jr. New Berlin, Union county, Pennsylvania, March 6.

A shaft about five feet long, is turned, for three and a half feet of its length, to a diameter of six inches, and then increasing in diame-

ter, along the remaining eighteen inches, to about eight inches. This shaft is made to revolve upon gudgeons in a suitable frame, but inclined from the horizon, the thicker end being the lowest. A spiral row of wooden pins is placed round the cylindrical part of the shaft, making three or four turns in its length. On the conical part of the shaft there are small steel pins, also driven spirally, but near together. A circular casing surrounds this shaft its whole length; that part of it in which the steel pins run is of sheet iron, punched to form a grater. The hopper is placed at the upper end of the casing, and as the shaft revolves the clover is carried within the casing by the wooden pins, until it arrives towards the other end, where it is operated upon by the apparatus described.

The claim is to the before described machine; and particularly to the spirally set pins for conveying the heads to the rubber, and the spirally set metal pins for rubbing it out.

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5. For a *Planing machine*, called the Horizontal Knife and Roller Plane; Uri Emmons, city of New York, March 6.

This machine, we are apprehensive, will not answer the purpose intended, unless the boards to be planed are first rived from trees perfectly straight in the grain; and even then we do not think that it would answer well. We shall be ready to retract the opinion thus expressed when a workman can be found who with a drawing knife can take a single shaving from end to end of a flooring board, and in this way leave it with a smooth finish.

The stuff to be planed is to pass between two iron rollers, either plain or fluted, the upper roller having on its ends iron fly wheels, which press it down on the board, and insure its feeding against the knife by which the planing is to be effected. The knife, or plane iron, is fixed exactly against the front of the upper feeding roller, extending along and cutting the whole width of the board at one operation. Cutting irons for tonguing and grooving are at the same time to act on its edges, and are at once to cut the tongue and the groove.

We do not think it necessary to describe the various accessory parts mentioned by the patentee, and figured in the drawing, as we have little doubt that those persons who have any knowledge upon the subject, will, from what we have already advanced, have arrived at the conclusion with which we commenced our remarks.

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6. For a *Machine for Moulding Bricks;* called "Drummond's Brick Moulder;" John Drummond, Whitestown, Oneida county, New York, March 6.

Without the aid of the engraver we cannot give an exact description of this machine, nor indeed are we aware that any thing further than a general idea of it is requisite. The prepared clay is put into a hopper, and the brick moulds placed upon a carriage, are forced, by means of a rack and pinion, under this hopper. As the brick moulds pass under, a row of rollers, seven in number, crossing the hopper near its bottom, and made to revolve by a band, forces the clay into the moulds. A wire, made to vibrate horizontally on the

upper surface of the moulds as they escape from the rollers, cuts off the superfluous clay, which is removed by a kind of scraper.

The use of the rollers, and the vibrating wire for cutting the superfluous clay from the mould, are the points relied on as new.

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7. For a *Medicine for the cure of Syphilis;* called "The Unfortunate's Friend;" Nicholas W. Bardean, city of New York, March 8.

In the first place a decoction is to be made by taking two pounds of liquorice root; of sarsaparilla root, guiacum, elder flowers, and raisins, each one pound; of mazereon root, burdock root, parsley root, and dried whortleberry leaves, each half a pound; putting them into four gallons of water, and reducing it to two by boiling. Into the warm, strained decoction, there is to be put of balsam copaiva and sweet spirits of nitre, each two pounds; of gum arabic, white sugar, cubebs and carbonate of soda, each one pound, and of gum opium one ounce.

This is the recipe, but it is given to us without any directions as to its exhibition. Should those who are so unfortunate as to be affected by the vile disease in question, depend for a cure upon the foregoing Friend, "Alas, poor Yorick!"

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8. For *Machinery for preparing Hides for Tanning;* Lewis Newsom, Gallipolis, Gallia county, Ohio, March 8.

There is to be a circular trough of about fifty feet in circumference, which is to be made of timber, and may be nine inches wide, and eight deep. A wheel of stone, or of wood, about four feet in diameter, is adapted to this trough by allowing it to revolve on the end of a horizontal lever, attached to a vertical shaft in the centre of the trough. Mills of this description are well known; and, as the patent is for the machinery employed, this ought to have some novelty.

Hides intended for tanning are to be softened in the trough, and those which have been limed are to have the lime worked out in it, preparatory to their going into the first bark liquor. When hides are to be put into the vats they are to be fastened to frames made for the purpose, on which they can be hooked; these frames are lowered into, or raised from the vats, by means of suitable tackle.

Hides have been suspended and lowered in similar ways, and the modes of effecting it have been made the subjects of patents.

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9. For an improvement in *Harness Saddle Trees;* Philo Washburn, Bristol county, Massachusetts, March 8.

This saddle tree is to be made entirely of wrought iron. In the middle, where it is fitted to the ridge of the horse's back it is to be made quite narrow, whilst the sides are widened and flattened out. The terrets and water hook screw into holes prepared for them, and the tree, when properly padded, is complete. The claim is to the wrought iron tree, as a substitute for wood, it being more compact and stronger than that material.

10. For a *Machine for cutting Sausage-Meat;* John Brannan, city of Baltimore, March 8.

The whole description of this machine, including the claim, extends to nine lines only, but as these refer to a drawing, we shall be obliged to be somewhat more prolix. The sausage meat is put into a round tub, or trough, which is to revolve on an axis. A horizontal axis above the tub carries a double crank and pitmen, which work knives up and down within the tub. These knives are kept in motion by turning a winch, or handle, on the shaft of which there is a cog wheel taking into a pinion on the crank shaft; and a vertical shaft, turned by an endless screw, on the horizontal one, has a pinion on its lower end, which, mashing into cogs surrounding the tub, causes it to revolve. The claim is to this last part of the apparatus. There is some slight difference in the mode in which this tub is made to revolve, and that of others which have received a similar motion, but in the principle of the machine there is nothing new, and its variation from others can scarcely be called an improvement.

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11. For *Rail-ways and Cars used thereon;* Jedediah Richards, Elbridge, Onondaga county, New York, March 9.

The rail-way is to be a single rail, sustained by suitable supports. Two wheels, in a frame made for the purpose, are to run on this rail, the car being suspended under it by iron rods attached to the frame of the wheels.

The claim is "to the before described improvements in rail-ways, and in the cars or carriages used thereon."

Single suspension rails were patented in England by Mr. H. R. Palmer, six or seven years ago, and are described in this journal for April, 1828; they, however, have never been brought into practical use. There is but little difference between the present plan and that proposed by Mr. Palmer; the principle of both is the same, and we do not think that Mr. Richards has made any improvement on that first suggested, nor has he alluded to it, but has taken his patent as though single rails were absolutely new.

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12. For a *Mill for Grinding Apples and Potatoes,* and for shelling corn; Edmund Harris, James Newton, Willard Webster, and Jehiel W. Dart, Truxton, Courtland county, New York, March 10.

A spindle, running vertically, carries the runner of this mill, which is a stone made hemispherical, or more or less curved above, but flat beneath. The cap stone is hollowed, like a bowl, to adapt it to the curvature of the lower stone, and has an eye in it for the spindle to pass through, and also for feeding.

"The invention claimed is the grinding apples, potatoes, and shelling corn, as above described, with stone, and in the cheapness and durability of the mill."

Whatever may be the merits of this mill, its claim to novelty is a very slender one; the contribution of each of the four inventors must

in fact be so minute as to be almost invisible, although it seems that there was "quite enough to swear by."

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13. For a machine for *Making Crackers, Ship Bread, &c.;* John Bruce and Charles Bruce, Brooklyn, King's county, New York, March 13.

A long sliding table, or platform, is to be fixed upon a suitable stand, or frame, with ledges to guide it, and cause it to slide forward and backward in a direct line. Upon this table the dough to be formed into crackers, ship bread, &c. is to be rolled out. There are three rollers, or cylinders, the gudgeons of which run in cheeks rising from the frame on each side of the platform, and having their axes nearly in the same horizontal plane, but not precisely so, the roller with which the dough first comes into contact being farther from the platform than the second, and the third, or last, being still nearer than the second, its distance being such as to reduce the dough to the thickness required. The first roller is turned by a crank, and on its ends are toothed wheels which take into the teeth of racks on each edge of the platform, thus forcing it to advance.

There is a fourth cylinder, called the cutting cylinder, which crosses the platform immediately in front of the last roller. This cylinder is surrounded with circular, or other formed, cutters, the edges of which extend down to the platform. Within each of the cutting moulds there may be docking points, a die with a name, &c. A plate, nearly filling the inside of the mould, and perforated, when necessary, to accommodate the dockers, is borne forward by spiral, or other springs, to force the cut cracker, &c. out of the mould.

The claims are to "the use of two or more cylindrical rollers successively, to reduce the dough to its desired thickness, in connexion with the aforesaid cutting cylinder; the use of the aforesaid cutting cylinders containing cutters of the ordinary description, whether it be so constructed as to make circular biscuits, or the same, or similar articles, of any other shape or form whatever."

We refer those who are interested in the subject of machines for manufacturing crackers, to the several patents for apparatus for that purpose, which we have formerly noticed. On comparing the description and claims above specified with those of Clark & Henderson, vol. vi. p. 302, and Fairbanks & Dunott, vol. viii. p. 343, we think it will appear that a considerable portion of the ground claimed by the present patentees, is such as has been previously occupied.

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14. For an improvement in the *Manner of supplying Steam Boilers;* Jesse Fox, Lowell, Middlesex county, Massachusetts, March 14.

Those who are well acquainted with the different modes which have been adopted for supplying boilers with water, know that it is sometimes done by causing a cylinder, or a conical plug, to revolve in a suitable case, like the key of a cock in its socket, and having at

one point, a cavity within it, which as it turns, is filled with water from a reservoir above it, and in its revolution delivers it therefrom into the boiler. The plan before us is of this character, but in the structure and arrangement of its parts appears to be new, and well conceived; without the aid of a plate, however, we can attempt no more than a very general description of it.

The revolving piece which has the cavities in it for the reception and supply of water, is a cylinder of iron four inches and a half in diameter, and one and a half in thickness; this cylinder revolves on a suitable axis, being enclosed for more than half its circumference in a casing, which is furnished with a flanch, by which the apparatus is attached to a boiler. A hole is made in the boiler to admit a projecting part of the revolving supply wheel, which is nearly equal to one-half of it. This wheel is perforated on opposite sides, so as to remove nearly one half of its substance. Imagine it to be divided into four parts, or quadrants, the part removed consists of two opposite quadrants, leaving a rim, however, of one-fourth of an inch in thickness at the outside, and an equal portion 'round the gudgeon at the centre. These cavities, as the wheel revolves, are alternately exposed to the pressure of water in a reservoir from which they are filled, and to the inside of the boiler, into which the water falls from them, both sides of the wheel being equally acted upon by the steam.

The perforation of the boiler is at the point intended for the water line, in order that the tendency of the wheel may be to carry back as much as it supplies when the boiler is sufficiently full. The claim is to the apparatus as described.

A principal objection to revolving wheels of this description is their gradual wear, which, although they may operate satisfactorily at first, soon unfits them for the duty they are to perform. Should this objection be removed, the principle is undoubtedly a good one.

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15. For a *Washing Machine;* Noah Morrison and John Lewis, Union Town, Fayette county, Pennsylvania, March 14.

This is called the "horizontal, double dasher, washing and scouring machine.

A trough has a shaft crossing it near its centre, and carrying two cranks; pitmen from these cranks cause two sliding dashers to traverse in the trough in opposite directions, and to squeeze between them and a breasting prepared for the purpose, the clothes put in at either end of the machine.

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16. For a *Mill for grinding Paints;* Oliver C. Harris, Sangerfield, Oneida county, New York, March 15.

On the upper part of a suitable frame a circular hopper, or curb, is placed; it is made of cast iron, and is to receive the paint to be ground. The lower part of this hopper is made conical to receive from below the runner, or nut, formed like that of the common coffee mill, this is also of cast iron, and has a shaft, or spindle, by which it

is to be turned, extending down to a bridge tree. There is an elastic scraper bearing against the under rim of the runner to scrape off the paint. The edges of the runner and of the hollow cone are to have teeth on them; and the shaft, or spindle, is to be turned by a crank carrying a toothed wheel, taking into a pinion on the shaft.

There is no claim made, which we think is just as it should be, obviating a great difficulty by saying nothing about novelty.

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17. For a *Faucet for drawing Liquids;* called Goodyear's spring and lever faucet; Charles Goodyear, city of Philadelphia, March 16.

These faucets, or cocks, have nearly the same external form with the block-tin cocks in common use; but instead of the screw plug in them, or the revolving key of the common cock, they are opened by raising a valve perpendicularly, which is kept down in its place by means of a spiral spring. The exterior end of the cock is a hollow vertical cylinder, the top of which is closed by a cap, whilst the lower end is left open. A rim or shoulder surrounds this lower end, rendering the opening smaller than the cylindrical barrel above it, and upon this shoulder the valve rests. The valve is a circular disk of metal, on to the lower side of which there is a tube that forms the spout, or adjutage of the cock; this tube fits exactly into the rim upon which the valve rests, and when the valve is raised a part of this tube slides up into the cylindrical chamber. A perforation is made in the side of the tube, which, when it is thus raised, allows the liquor from the shank of the cock to flow through it. A spiral spring, extending from the cap of the chamber, on to the top of the valve, keeps it in its seat. The valve is raised by two wires which descend from the top of the chamber, at the outside, and opposite to each other, and are fastened below into ears projecting from the tube. These wires are connected at the top, and when raised are acted upon by a small lever; and to keep them in their proper places and cause them to rise vertically, they slide through holes in projecting rims made for that purpose.

The claim is to the application of a spiral spring to a valve in the manner described.

A cock so constructed will undoubtedly operate very well, but the spiral spring being constantly surrounded by the liquor, will, we apprehend, be liable to corrosion by some liquids, or to be furred up by others.

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18. For a *Silk Reel,* for reeling silk from cocoons; Eliphalet Snow, Mansfield, Tolland county, Connecticut, March 6.

The silk reel is a very simple instrument, and although it has been made in various forms, its essential parts are the same. The present patentee has described his own form of reel, but without telling what particular advantages it possesses over others, or claiming any part as new. As we are unable to supply these deficiencies, we shall not attempt to follow him in his description.

19. For a *Revolving Lath Cutter;* Simon Willard, Cincinnati, Hamilton county, Ohio, March 16.

A cylinder, which, for laths of the ordinary length, may be about five feet in diameter, and of the length of the lath, is made to revolve on a strong iron shaft. The ends of the cylinder are best made of cast iron, as the whole machine must have great strength and weight. The periphery of the cylinder is of wood, and turned perfectly true; one or more cutters, formed of strong flat iron bars, faced with steel, extend from end to end of the cylinder, the distance from which to the cutting edge forms the gauge for the thickness of the lath. A horizontal bar of wood, having on it one of iron, serves as a rest upon which the timber to be cut is held. The edge of the board, held upon the rest, is forced up against the face of the cylinder, whilst the latter is revolving. The width of the lath is determined by the thickness of the board used.

There are several accessory parts, such as a revolving apron, or other contrivances, for carrying off, and collecting together, the laths, but these we do not think it necessary to describe.

The claim is to the combination of revolving cutters, a cylinder, and other machinery, as described, for the purpose of cutting laths.

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20. For a *Smoke Ventilator;* Silas Smith, Hamilton, Butler county, Ohio, March 17.

This smoke ventilator is a modification of the well known valve, or damper, employed to open or close the throat of a chimney. Its distinguishing feature consists in making the sloping back of the fire place of cast iron, and fixing it so that it will work upon hinges, or pivots, at bottom. This is to be altered in its slope by means of endless screws fixed near its upper part. When brought forward, it closes the throat in any desired degree. The upper part of this moveable plate curves back, to favour the exit of the smoke, and to form a mechanical obstruction to a downward draft.

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21. For *Machinery for Printing;* John Hatch, Boston, Massachusetts, March 21.

This is a new contribution to the list of power presses, the introduction of which has done so much in facilitating the typographic art. In a complex machine of this description, the parts are too numerous, and the peculiar combination which constitutes the essential characteristics of a new or improved machine, too dependent upon minute points to admit of their being given without drawings. To such particulars the claims made by the present patentee refer, and we therefore dismiss the subject, at present, without an attempt at description.

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22. For a *Thrashing Machine;* Abel Lock and William Coleman, jr., Frederick city, Frederick county, Maryland, March 21.

This machine is described with much brevity, and makes no pretention to novelty. We are told that there is in the first place a

suitable frame; in the second, a hopper or revolving apron for feeding; in the third, a hollow revolving cylinder, the perimater being made of plates of iron, passing spirally from head to head, and carrying projections, or teeth; and fourthly, a concave bed with similar teeth. Having said thus much, the patentees sign their names, and take their leave.

23. For a *Clothes Line Vice;* Samuel Pryor, Salem, Salem county, New Jersey, March 22.

A strip of hickory, about six inches long, is to be bent in the middle, so as to bring the two ends parallel to each other, forming a clamp about two and a half inches long. A wooden screw is made to draw these together, and the machine is then prepared to hold clothes upon lines whilst drying.

We do not think that this patented instrument is, upon the whole, superior to the common clamp, as it will, when caught in a shower, or otherwise exposed to wet, be found to swell, and this will interfere with the working of the screw.

24. For a *Shingle Cutting Machine*; George Wolf, Clear Creek, Fairfield county, Ohio, March 22.

It appears, so far as we can collect from an obscure description, and a still worse drawing, that knives are to be set in a stock, which stock is to be made to traverse against the block by a crank motion. Such machines are quite common, and have but little merit, performing the work very imperfectly.

25. For an improvement in the *Saw Mill;* Vachel Blaylock, Bellefontaine, Logan county, Ohio, March 24.

N. B. The word improvement, when applied to patents, is not by any means to be taken in its ordinary acceptation, as in numerous instances it means any thing rather than the rendering of a machine better than it was previously. In a patent dictionary the definition which would most generally apply would be *alteration*, as this would include both the mending and the marring of any such article as may be altered.

This improved saw mill is to be moved by the power of a horse, kept walking in a circle, and thereby turning a vertical shaft in the common and long approved way. A wheel on the lower end of the vertical shaft, gears into one on a horizontal shaft, which is to be so covered as to allow the horse to walk over it. This horizontal shaft carries a vertical spur wheel eight feet in diameter, which turns two pinions, the shafts of which run on bearings in suitable supports. According to one part of the specification there are to be cranks on the far ends of these pinion shafts, each carrying a saw frame; but according to another part there are to be cams upon each of the pinion shafts, operating on the opposite ends of a lever having a fulcrum in its centre, and made to vibrate like a scale beam by the action of these cams on its lower side; the drawing seems to confirm this lat-

ter structure as the approved one. The ends of this lever are employed as substitutes for cranks in operating upon saw frames. The whole gearing as described, with the addition of the friction of the cams, acting in the way shown in the drawing, will add a liberal percentage to the necessary friction, and prevent all danger of the horses employed suffering from dyspepsia if labour will prevent that disease.

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26. For a *Bark Mill;* Daniel Humberd and George Downs, M'Connelstown, Bedford county, Pennsylvania, March 27.

The claim made by these patentees is to "the before described machine or mill for grinding bark," adding "we make no claim to the runner and bed." What they call the runner and bed, is the common cast iron bark mill. The shaft of this is to be turned by animal power in the common way, a horizontal cog wheel giving motion to a trundle head on the shaft of the mill. A circular trough, or curb, is to catch the bark as it falls, and prevent it from scattering.

It is quite plain from the foregoing that the patentees imagine that it is the patent, and not the originality of the thing patented, which gives the right, as there is not the slightest pretension made by them to the invention of any thing, nor the slightest room to urge such a pretension.

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27. For an improvement in the construction of *Backs for Forges* and other fires; Philo C. Curtis, Utica, Oneida county, New York, March 27.

This forge back is a box made of cast iron, about twelve inches long and ten high, and it has a depth from the fire back of about six inches. The object proposed is to supply this box with wind in such a way as to blow heated air into the fire, whilst that side of it which is in contact with the fire shall be preserved from burning out.

The box is cast in two parts, capable of being put together so as to be air tight. The wind from the bellows passes in at one end of it, and escapes into the fire through a hole in the front plate, which forms the forge back. There is a centre plate, twelve inches long and ten high, which is put into the box, dividing it into two chambers; this centre plate is perforated with numerous small holes, and has one of a larger size corresponding with the hole in the front plate; the tube, or tuyere, which conducts the wind to the fire, fits into both these holes, so that all the wind must come from the posterior chamber, whilst the wind from the bellows passes into the anterior chamber.

The operation will now be readily understood. The wind which passes into the anterior chamber, having to pass through the small holes in the centre plate, before it can arrive at the tuyere, and coming into contact with the heated plate which forms the forge back, becomes itself heated, and in becoming so cools the front plate.

The patentee says that a considerable portion of coal is saved by thus using heated air. On this subject we refer our readers to p. 339

of the last volume, where the advantage of supplying a furnace with heated air is particularly noticed.

The claim in the present case is to applying wind from the bellows against the back of a plate exposed to the fire, and also to the particular mode of so doing, as explained in the specification.

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28. For an improvement in the *Mode of Spinning Wool*, for the manufacture of coarse or heavy fabrics, and particularly for ingrain carpeting; William Calvert, Royal Southwick, and Alfred Messinger, Lowell, Middlesex county, Massachusetts. The former an alien, having resided here two years; the two latter citizens of the United States. March 31.

The machine here patented is well represented in the drawing, and explained with sufficient clearness in the specification; still the parts which are new are not designated, but left to be inferred by those acquainted with such machinery. This does not fulfil the requirements of the law, yet we presume that by a liberal construction of it, the rights of the patentees might be sustained.

The patentees state that this machine resembles those in general use for spinning worsted and cotton; but that from placing the rollers nearer together than in worsted machinery, and making them larger than in that for cotton, it produces yarn which could not be obtained from either of them.

The wool is taken from the carding condenser on to a feeding cylinder, whence it passes through all the rollers, of which there are three pair; two being small, and placed between the ordinary drawing rollers. The feeding cylinder, it is said, has never before been applied to the throstle frame.

The difference in the mode of spinning from that in other machines is that it is effected by a continuous motion; the thread being wound on the bobbins, or spools, as fast as the roping is discharged from the rollers, the rollers not stopping, as in the common machines, whilst the roping is drawn and twisted.

It is averred that three times the ordinary quantity may be spun by one of these machines; six spindles producing as much as eighteen have heretofore done.

The quality of the yarn is said to be much improved, the fibres being drawn nearly straight, as in worsted. Several other advantages are enumerated by the inventors, who have taken much more pains to inform us what the machine does, than how it accomplishes its work. Patentees are often anxious to make known in their specifications the utility of their inventions, a point which may be omitted altogether without any disadvantage, the main question being that of novelty.

Analysis of the Report, &c. on Steam Carriages.

Report on Steam Carriages by a Committee of the House of Commons of Great Britain. With the minutes of Evidence, and Appendix. Reprinted by order of the House of Representatives of the United States. (1832.)*

We are indebted to this reprint of the report on steam carriages, by a committee of the House of Commons of England, for the means of placing before our readers the results of a most interesting investigation into the progress made in the attempts at locomotion, by steam carriages, upon common turnpike roads.

In this country was made the first successful attempt to move a carriage, upon a common road, by steam power applied to give rotation to the wheels. In the year 1804 the dredging machine of Oliver Evans was propelled by the adhesion of its wheels from Broad street to the Schuylkill, and the engine of the machine was further used to propel, by a paddle wheel, the scow in which it was placed, down the Schuylkill, and up the Delaware, to the station where it was to be used.

It may be yet some time before the ingenuity of our countrymen is turned to the application of steam power which we are about to consider: our roads must be more or less improved both in relation to their longitudinal and to their transverse section. To induce this expense, an amount of travelling must be secured, between our inland towns, not likely to take place for some time. The magnificent water courses which facilitate our communication between the large cities on the Atlantic board, and between the growing towns of the west, have led to the acknowledged superiority which we enjoy over our transatlantic brethren (the English,) in the application of steam to navigation: our extent of territory, and the sparseness of its population have been strong inducements to a devoted attention to this subject. The peculiar facilities of rail-road communication between vast commercial and manufacturing depots, has caused England to precede us very far in that mode of communication, and, consequently, in the application of steam power to locomotion upon rail-ways. Until steam coaches shall have been made to travel upon common roads at a more rapid rate than our combined water and land communications can enable us to attain, thereby to shorten the time of passage between some of our large cities, we can hardly expect that this species of locomotion will receive much of the attention of the public. By keeping up with the state of information in England upon this subject, we shall always be prepared to take advantage of a proper opening for the introduction of such a mode of communication, with the advantage of the experience which might otherwise have been dearly bought. No doubt there are portions of our better roads which might be made available, for a short distance, for profitable speculation in this new sort of locomotion.

Much of the evidence before the committee of the House of Com-

* Com. Pub.

mons is of local interest merely, and many of the statements would find no application with us: a part even of the report of the committee might, perhaps, have been omitted, or have been condensed, without injury to the interests of our readers; we have, however, preferred to insert it unmutilated.

The inquiry with which this committee was charged grew out of representations made by those interested in the new application of steam to locomotion, in relation to the heavy tolls imposed upon their carriages on the different turnpikes. The subject, as referred to the committee, took, however, a wider range than that of a mere inquiry in relation to the tolls. The objects of examination were, first, in relation to the tolls which ought to be imposed upon coaches and other vehicles propelled by steam or gas upon turnpike roads, together with the tolls at present imposed; second, in relation to the present state and future prospects of this application to locomotion upon common roads, with the probable utility resulting to the public from such an application.

We purpose first to give the report of the committee, and afterwards, by extracts from the minutes of evidence, and condensed views of the more interesting parts of it, to put our readers in possession of the material facts developed in the examination.

Report of the Committee on Steam Carriages. Charles D. O. Jephson, *Chairman.*

"The committee proceeded, in the first instance, to inquire how far the science of propelling carriages on common roads by means of steam or mechanical power, had been carried into practical operation; and whether the result of the experiments already made had been sufficiently favourable to *justify* their recommending to the House that protection should be extended to this mode of conveyance, should the tolls imposed on steam carriages, by local acts of parliament, be found prohibitory or excessive.

"In the progress of their inquiry, they have extended their examination to the following points, on which the chief objections to this application of steam have been founded, viz.—the insecurity of carriages so propelled, from the chance of explosion of the boiler, and the annoyance caused to travellers, on public roads, by the peculiar noise of the machinery, and by the escape of smoke and waste steam, which were supposed to be inseparable accompaniments.

"It being also in charge to the committee, 'to report upon the proportion of tolls which should be imposed upon steam carriages,' they have examined several proprietors of those already in use, as to the effect produced on the surface of roads by the action of the propelling wheels.

"As this was too important a branch of their inquiry to rest entirely on the evidence of individuals, whose personal interest might have biassed their opinions, the committee also examined several very scientific engineers, by whose observations, on the causes of the ordinary wear of roads, they have been greatly assisted.

"The committee were directed also to report 'on the probable utility which the public may derive from the use of steam carriages.' On this point they have examined a member of the committee, well known for his intelligence and research on subjects connected with the interests of society, and they feel that they cannot fulfil this part of their instructions better than by merely referring the house to the evidence of Colonel Torrens.

"These inquiries have led the committee to believe that the substitution of inanimate for animal power, in draught on common roads, is one of the most

important improvements in the means of internal communication ever introduced. Its practicability they consider to have been fully established; its general adoption will take place more or less rapidly, in proportion as the attention of scientific men shall be drawn, by public encouragement, to further improvement.

"Many circumstances, however, must retard the general introduction of steam as a substitute for horse power on roads. One very formidable obstacle will arise from the prejudices which always beset a new invention, especially one which will at first appear detrimental to the interests of so many individuals. This difficulty can only be surmounted by a long course of successful, though probably unprofitable experiment. The great expense of the engines must retard the progress of such experiments. The projectors will, for a long period, work with caution, fearing not only the expense incurred by failure, but also that too sudden an exposure of their success would attract the attention of rivals. It is difficult to exemplify to the house how small and apparently unimportant an adaptation of the parts of the machinery, or of the mode of generating or applying the steam, may be the cause of the most rapid success; yet he who, by a long course of experiments, shall have first reached this point, may be unable to conceal the improvement, and others will at once reap the benefit of it.

"The committee are convinced, that the real merits of this invention are such, that it may be safely left to contend with these and similar difficulties; there are others, however, from which the legislature can alone relieve it. Tolls, to an amount which would utterly prohibit the introduction of steam carriages, have been imposed on some roads; on others, the trustees have adopted modes of apportioning the charge which would be found, if not absolutely prohibitory, at least to place such carriages in a very unfair position as compared with ordinary coaches.

"Two causes may be assigned for the imposition of such excessive tolls upon steam carriages. The first a determination on the part of the trustees, to obstruct, as much as possible, the use of steam as a propelling power; the second, and probably the more frequent, has been a misapprehension of their weight and effect on roads. Either cause appears to the committee a sufficient justification for their recommending to the house, that legislative protection should be extended to steam carriages with the least possible delay.

"It appears from the evidence that the first extensive trial of steam as an agent in draught on common roads, was that by Mr. Gurney, in 1829, who travelled from London to Bath, and back, in his steam carriage. He states, that although a part of the machinery which brings both the propelling wheels into action when the full power of the engine is required, was broken at the onset, yet that, on his return, he performed the last eighty-four miles, from Melksham to Cranford bridge, in ten hours, including stoppages. Mr. Gurney has given to the committee very full details of the form and power of his engine, which will be found in the evidence.

"The committee have also examined Messrs. Summers and Ogle, Mr. Hancock, and Mr. Stone, whose steam carriages have been in daily use for some months past on common roads. It is very satisfactory to find that, although the boilers of the several engines described, vary most materially in form, yet that each has been found fully to answer the expectation of its inventor. So well, in fact, have their experiments succeeded, that in each case where the proprietors have ceased to use them, it has only been for the purpose of constructing more perfect carriages, in order to engage more extensively in the business.

"When we consider that these trials have been made under the most unfavourable circumstances—at great expense—in total uncertainty—without any of those guides which experience has given to other branches of engineering—that those engaged in making them are persons looking solely to their own interests, and not theorists attempting the perfection of ingenious models—when

we find them convinced after long experience, that they are introducing such a mode of conveyance as shall tempt the public, by its superior advantages, from the use of the admirable lines of coaches which have been generally established—it surely cannot be contended that the introduction of steam carriages on common roads is, as yet, an uncertain experiment, unworthy of legislative attention.

"Besides the carriages already described, Mr. Gurney has been informed that from 'twenty to forty others are being built by different persons, all of which have been occasioned by his decided journey in 1829.'

"The committee have great pleasure in drawing the attention of the house to the evidence of Mr. Farey. His opinions are the more valuable from his uniting, in so great a degree, scientific knowledge to a practical acquaintance with the subject under consideration. He states that he has 'no doubt whatever but that a steady perseverance in such trials will lead to the general adoption of steam carriages:' and again, 'that what has been done proves to his satisfaction the practicability of impelling stage coaches (by steam,) on good common roads, in tolerably level parts of the country, without horses, at a speed of eight or ten miles per hour.'

"Much, of course, must remain to be done in improving their efficiency; yet Mr. Gurney states that he has kept up steadily the rate of twelve miles per hour; that 'the extreme rate at which he has run is between twenty and thirty miles per hour.'

"Mr. Hancock 'reckons that, with his carriage he could keep up a speed of ten miles per hour, without injury to the machine.'

"Mr. Ogle states 'that his experimental carriage went from London to Southampton, in some places, at a velocity of from thirty-two to thirty-five miles per hour.'

"'That they have ascended a hill rising one in six, at sixteen and a half miles per hour, and four miles of the London road at the rate of twenty-four miles and a half per hour, loaded with people.'

"'That his engine is capable of carrying three tons weight, in addition to its own.'

"Mr. Summers adds, 'that they have travelled in the carriage at the rate of fifteen miles per hour, with nineteen persons on the carriage, up a hill one in twelve.'

"'That he has continued for four miles* and a half, to travel at the rate of thirty miles per hour.'

"'That he has found no difficulty of travelling over the worst and most hilly roads.'

"Mr. James Stone states that 'thirty-six persons have been carried on one steam carriage.'

"'That the engine drew five times its own weight nearly, at the rate of from five to six miles per hour, partly up an inclination.'

The several witnesses have estimated the probable saving of expense to the public, from the substitution of steam power for that of horses, at from one-half to two-thirds. Mr. Farey gives as his opinion, 'that steam coaches will, very soon after their first establishment, be run for one-third of the cost of the present stage coaches.'

"Perhaps one of the principal advantages resulting from the use of steam, will be, that it may be employed as cheaply at a quick as at a slow rate; 'this is one of the advantages over horse labour, which becomes more and more expensive as the speed is increased. There is every reason to expect that, in the end, the rate of travelling by steam will be much quicker than the utmost speed of travelling by horses; in short, the safety to travellers will become the limit to speed.' In horse draught the opposite result takes place; 'in all cases horses

* In the original, "hours:" Mr. Summers states this to be a mistake, and directs the substitution which we have made.—Mech. Mag. March 1832, p. 443. [Reviewer.]

lose power of draught in a much greater proportion than they gain speed, and hence the work they do becomes more expensive as they go quicker.' On this and other points referred to in the report, the committee have great pleasure in drawing the attention of the house to the valuable evidences of Mr. Davies Gilbert.

"Without increase of cost, then, we shall obtain a power which will insure a rapidity of internal communication far beyond the utmost speed of horses in draught; and although the performance of these carriages may not have hitherto attained this point, when once it has been established, that at equal speed we can use steam more cheaply in draught than horses, we may fairly anticipate that every day's increased experience in the management of the engines, will induce greater skill, greater confidence, and greater speed.

"The cheapness of the conveyance will probably be for some time a secondary consideration. If at present it can be used as cheaply as horse power, the competition with the former modes of conveyance will first take place as to speed. When once the superiority of steam carriages shall have been fully established, competition will induce economy in the cost of working them. The evidence, however, of Mr. Macneil, showing the greater efficiency, with diminished expenditure of fuel, by locomotive engines on rail-ways, convinces the committee that experience will soon teach a better construction of the engines, and a less costly mode of generating the requisite supply of steam.

"Nor are the advantages of steam power confined to the greater velocity attained, or to its greater cheapness than horse draught. In the latter, danger is increased, in as large a proportion as expense, by greater speed. In steam power, on the contrary, 'there is no danger of being run away with, and that of being overturned is greatly diminished. It is difficult to control four such horses as can draw a heavy carriage ten miles per hour, in case they are frightened or choose to run away; and for quick travelling they must be kept in that state of courage, that they are always inclined for running away, particularly down hills and at sharp turns of the road. In steam, however, there is little corresponding danger, being perfectly controllable, and capable of exerting its power in reverse in going down hills.' Every witness examined has given the fullest and most satisfactory evidence of the perfect control which the conductor has over the movement of the carriage. With the slightest exertion it can be stopped or turned, under circumstances where horses would be totally unmanageable.

"The committee have, throughout their examinations, been most anxious to ascertain whether the apprehension very commonly entertained, that an extensive use of these carriages on roads would be the cause of frequent accidents and continued annoyance to the public, were well founded.

"The danger arising from the use of steam carriages, was stated to be twofold; that to which passengers are exposed from explosion of the boiler, and the breaking of the machinery, and the effect produced on horses by the noise and appearance of the engine.

"Steam has been applied as a power in draught in two ways: in the one, both passengers and engine are placed on the same carriage; in the other, the engine carriage is merely used to draw the carriage in which the load is conveyed. In either case, the probability of danger from explosion has been rendered infinitely small, from the judicious construction of boiler which has been adopted.

"These boilers expose a very considerable surface to the fire, and steam is generated with the greatest rapidity. From their peculiar form, the requisite supply of steam depends on its continued and rapid formation; no large and dangerous quantity can at any time be collected. Should the safety valve be stopped, and the supply of steam be kept up in a greater abundance than the engines require, explosion may take place, but the danger would be comparatively trifling, from the small quantity of steam which could act on any one portion of the boiler. As an engine, invented by Mr. Trevithick, has not been as yet

applied to carriages, the committee can do no more than draw the attention of the house to the ingenuity of its contrivance. Should it in practice be found to answer his expectation, it will remove entirely all danger from explosion. In each of the carriages described to the committee, the boilers have been proved to a considerably greater pressure than they can ever have to sustain.

"Mr. Farey considers that 'the danger of explosion is less than the danger attendant on the use of horses in draught; that the danger in these boilers is less than in those employed on the railway, although there even, the instances of explosion have been very rare.' The danger arising to passengers from the breaking of the machinery, need scarcely be taken into consideration. It is a mere question of delay, and can scarcely exceed in frequency the casualties which may occur with horses.

"It has been frequently urged against these carriages, that wherever they shall be introduced, they must effectually prevent all other travelling on the road, as no horse will bear quietly the noise and smoke of the engine.

"The committee believe that these statements are unfounded. Whatever noise may be complained of, arises from the present defective construction of the machinery, and will be corrected as the makers of such carriages gain greater experience. Admitting even that the present engines do work with some noise, the effect on horses has been greatly exaggerated. All the witnesses accustomed to travel in these carriages, even on the crowded roads adjacent to the metropolis, have stated that horses are very seldom frightened in passing. Mr. Farey and Mr. Macneil have given even more favourable evidence in respect to the little annoyance they create.

"No smoke need arise from such engines. Coke is usually burned in locomotive engines, on rail-ways, to obviate this annoyance; and those steam carriages which have been hitherto established also burn it. Their liability to be indicted as nuisances will sufficiently check their using any offensive fuel.

"There is no reason to fear that waste steam will cause much annoyance. In Mr. Hancock's engine it passes into the fire, and in other locomotive engines it is used in aid of the power, by creating a quicker draught and more rapid combustion of the fuel. In Mr. Trevithick's engine it will be returned into the boiler.

"The committee not having received evidence that gas has been practically employed in propelling carriages on common roads, have not considered it expedient to inquire as to the progress made by several very scientific persons who are engaged in making experiments on gases, with the view of procuring a still cheaper and more efficient power than steam.

"The committee having satisfied themselves that steam has been successfully adopted as a substitute for horse power on roads, proceeded to examine whether tolls have been imposed on carriages thus propelled, so excessive as to require legislative interference, and also to consider the rate of tolls by which steam carriages should be brought to contribute, in fair proportion with other carriages, to the maintainance of the roads on which they may be used.

"They have annexed a list of those local acts in which tolls have been placed on steam, or mechanically propelled carriages.

"Mr. Gurney has given the following specimens of the oppressive rates of tolls adopted in several of these acts: On the Liverpool and Prescot road, Mr. Gurney's carriage would be charged £2 8s. while a loaded stage coach would pay only 4s. On the Bathgate road the same carriage would be charged £1 7s. 1d., while a coach drawn by four horses would pay 5s. On the Ashburnham and Totness road Mr. Gurney would have to pay £2, while a coach drawn by four horses would be charged only 3s. On the Teignmouth and Dawlish roads the proportion is 12s. to 2s.

"Such exorbitant tolls on steam carriages can only be justified on the following grounds:

"First, because the number of passengers conveyed on, or by, a steam carriage will be so great as to diminish (at least the extent of the difference of the

rate of toll,) the total number of carriages used on the road; or, secondly, because steam carriages induce additional expense in the repairs of the road.

"The committee see no reason to suppose that, for the present, the substitution of steam carriages, conveying a greater number of persons than common coaches, will take place to any very material extent; and, as to the second cause of increased charge, the trustees, in framing their tolls, have probably not minutely calculated the amount of injury to roads likely to arise from them.

"The committee are of opinion that the only ground on which a fair claim to toll can be made on any public road, is to raise a fund which, with the strictest economy, shall be just sufficient, first, to repay the expense of its original formation; secondly, to maintain it in good and sufficient repair.

"Although the committee anticipate that the time is not far distant when, in framing a scheme of toll for steam carriages, their general adoption, and the great number of passengers which will be conveyed on a small number of vehicles, will render it necessary not only to consider the amount of injury actually done to the road, but also the amount of debt which may have been incurred for its formation and maintenance; yet at present they feel justified by the limited number of such carriages, and by the great difficulties they will have to encounter, in recommending to the house, that in adopting a system of toll, the proportion of 'wear and tear' of roads by steam, as compared with other carriages, should alone be taken into consideration.

"Unless an experiment were instituted on two roads, the one reserved solely for the use of steam coaches, the other for carriages drawn by horses, for the purpose of ascertaining accurately the relative wear of each, it would be quite impossible to fix with certainty the proportion of tolls to which, on the same road, each class of vehicles should be liable. To approximate, however, as nearly as possible to the standard of relative wear, the committee have compared the weights of steam carriages with those of loaded vans and stage coaches. They have tried to ascertain the causes of the wear of roads; also the proportion of injury done by the feet of horses and the wheels of coaches; how far that injury is increased by increased velocity, and also in what degree the wear of roads by loaded carriages may be decreased by any particular form of wheel.

"The committee would direct the attention of the house especially to the evidence of Mr. Macneil, whose observations on this branch of the subject, being founded on a long course of very accurate experiment, are peculiarly interesting and useful. He estimates that the feet of horses drawing a fast coach, are more injurious to the road than the wheels, in the proportion of three to one, nearly; that this proportion will increase with the velocity; that by increasing the breadth of the tires of the wheels, the injury done to roads by great weights may be counteracted. He considers that, on a good road, one ton may be safely carried on each inch of width of tire of the wheels.

"Mr. M'Adam and Mr. Telford have given corresponding evidence as to the greater wear caused by horses' feet, than by wheels of carriages.

"Each of the above witnesses agrees, that adding the weight of the horses to that of the coach, and comparing the injury done to a road by a steam carriage of a weight equal to that of the coach and horses, (the wheels being of a proper width of tire,) the deterioration of the road will be much less by the steam carriage than by the coach and horses.

"As to the injury to roads which is anticipated from the 'slipping' of the wheels, it may safely be left to the proprietors to correct: the action of the wheel slipping involves a waste of power, and a useless expenditure of fuel, which, for their own sakes, they will avoid.

"Apprehension has also been entertained that, although the peculiar action of the wheels may not be injurious, yet that, from the great power which may be applied if the steam were worked at very high pressure, or if the size of the engine were increased, greater weight might be carried than the strength of the road could bear.

"Undoubtedly, in proportion to the advance of the science, will be the increase of weight drawn by an engine with a given expenditure of fuel; but there are many practical difficulties to be surmounted before the weight so drawn can reach the point when it could be destructive of roads. There are no theoretical reasons against the extension of the size of the engines. The difficulties, according to Mr. Gurney, are of a practical nature, and only in the 'difficulty of management of a large engine.' In proportion as we augment the power of the engines, we must increase their strength, and consequently their weight; the greater weight will be a material diminution of their efficiency. To a certain extent the power may be increased in a greater ratio than the weight, but with our limited knowledge of the application of steam, and with the present formation of the public roads, the point will be very soon attained, when the advantage of increased power will be counterbalanced by the difficulties attendant on the increased weight of the engines.

"The weight of the steam carriages at present in use, varies from 53 to 80 cwt.; but it must be recollected that they are mere models; they were made with attention to strength only, to bear the uncertain strain to which they would be exposed in the course of experiments, and a very considerable diminution of weight may be anticipated.

"The weight drawn, at the rate of ten miles per hour, by Mr. Gurney's engine, has not, on any extent of road, exceeded the weight of the drawing carriage; nor is it likely, with the difficulties to be encountered on the present lines of road, from their quality and the numerous ascents, that the weight drawn will be in excess of the strength of the roads. The immense quantity of spare power required to surmount the different degrees of resistance likely to occur, would render the engine too unmanageable. This will appear evident from the force of traction required to draw a wagon over the Holyhead and Shrewsbury road, which varied from 40 to upwards of 300 lbs.

"In considering the effect on roads, we must not overlook one peculiarity in which they have a great advantage over other carriages. In coaches drawn by horses, the power being without the machine to be removed, it becomes an object of the greatest importance to give as much effect as possible to the power, by diminishing the resistance arising from the friction of the wheels upon the surface of the road. For this purpose, the proprietors of coaches and wagons have adopted every possible contrivance, so to reduce the tires of their wheels, that a very small portion of them may press on the road; in some coaches they are made circular in their cross section, so that the entire weight of the carriage presses on a mere point; should the materials be soft, such wheels cut their way into the road like a sharp instrument. The owners of wagons too have adopted a similar plan. Mr. Macneil states that the actual bearing part of the tire of apparently broad wheeled wagons, is reduced to three inches by the contrivance of one band of the tire projecting beyond the others.

"With steam, on the contrary, a certain amount of adhesion to the roads is required to give effect to the action of the machinery, or the wheels would slip round and make no progress. It appears of little importance, therefore, so far as relates to the engine, whether the requisite amount of friction be spread over a broad surface of tire, or be concentrated to a small point; but as the wheels, by being too narrow, would have a tendency to bury themselves in every soft or newly made road, and thus raise a perpetual resistance to their own progress, it actually becomes an advantage to adopt that form which is least injurious to the road. The proprietors, who have been examined on this point, seem to be quite indifferent as to the breadth of tire they may be required to use.

"These considerations have convinced the committee, that the tolls enforced on steam carriages have, in general, far exceeded the rate which their injuriousness to roads, in comparison with other carriages, would warrant; they have

found, however, considerable difficulty in framing a scale of tolls applicable to all roads, in lieu of those authorized by several local acts.

"With this view they have carefully examined the various modes of imposing toll, either suggested by the witnesses or already adopted.

"They are as follows:

"1. To place a toll proportioned to the weight of the carriage and load.

"2. On the number of passengers.

"3. On the horse power of the engine.

"4. On the number of wheels.

"5. An unvarying toll.

"Each of these plans seems liable to serious objections, which the committee beg to submit to the house.

"No plan of toll has been more frequently recommended than that of a charge in proportion to the weight of the engine and load. As this is the most plausible, and (if it could be levied without other disadvantages,) would probably be the fairest standard, the committee have considered it right to state, at some length, their reasons for not recommending its adoption.

"If weight be taken as the standard, the toll must be a fixed charge, either upon the weight of the engine and carriage, without reference to the load; or upon an estimated average of the load carried; or a fluctuating charge, according to the weight, at the several periods of a journey.

"The first would be at least free from the uncertainty of the other two, and therefore would be preferable; but what scale of charge per cwt. could the committee recommend as applicable to all roads? Their toll should vary according to every different rate of charge on carriages; besides, it would appear to the trustees very unjust to exclude the consideration of that which would be deemed the most material cause of the wear of their roads; viz. the load.

"A fluctuating charge on weight would be most injurious to a carriage which will mainly depend for success on its speed; constant altercations would take place between the toll collectors and proprietors; a minute calculation would be required at every turnpike gate; in fact, unless an accountant were placed at each, the committee cannot conceive how the proportions could be satisfactorily arranged, nor would there be any desire, on the part of the toll collector, to shorten the delay occasioned by these interruptions.

"Mr. Gurney has delivered in a scale of tolls graduated according to weight and width of tire of the wheel. As this has been drawn up by a person interested in the success of steam carriages, it might have been expected to be more favourable to them. The committee, however, have not adopted it, because of the difficulties and interruptions which a fluctuating rate of toll would induce; besides, this scale purports to be intended for a road where 3d. is charged for a horse drawing, and 1d. for a horse not drawing; the scale would be inapplicable therefore when the charge was 2d. and 1d., 3d. and 1½d., 4d. and 1d., 4d. and 1½d., 8d. and so on. Again, what standard of weight, in relation to horse coaches, could be adopted? The average weight of loaded coaches differs very much on different roads. It has been suggested, that a loaded coach, including the weight of four horses, would weigh on an average four tons; and that if 6d. per horse were chargeable to the coach, 6d. per ton should be placed on a steam carriage; this would be unjust, as vans, which frequently weigh upwards of six tons, would only pay 2s., and a steam carriage would pay 3s. Even if the injury done to the road by each were equal, this would be an unfair toll; but it will appear more evidently unjust if the greater proportionate injury done by the feet of horses drawing, than by the propelling wheels, be taken into consideration.

"The object of every steam coach proprietor will be to attain the greatest possible lightness of machinery and engine; because thereby he renders his power more efficient for the draught of the remunerating load. To place the toll on the weight of the engine would tend to induce him to decrease the

strength of his boiler and machinery to an extent which might be dangerous to the passengers, and very detrimental to the success of steam travelling, as the public will easily be led to believe that the accidents really occurring from injudicious legislation, were inseparable from the adoption of this power as an agent in propelling carriages.

"The only fair plea for charging tolls on such carriages in proportion to their weight, is to prevent a load being propelled or carried which would permanently injure the road; within this limit it would be as injudicious to interfere with their progressive efficiency, (which can only result from improvements of the machinery and the system of generating and applying steam,) as it would be to tax carriages drawn by large and well-bred horses, more heavily than such as were drawn by horses in worse condition, and of smaller size and power.

"The roads at present have to sustain wagons, weighing, at times, with their horses, nearly ten tons; it is in evidence, that the breadth of wheels required by various acts of Parliament, is so easily evaded, that it affords no protection to the road. There appears to the committee no fair reason to suppose that steam carriages, approaching even to this weight, will be used on any turnpike road, at least for a very considerable period, during which the increase of weight will be gradual, and will give warning to the legislature when it should interfere.

"To charge a toll according to the number of passengers conveyed, is scarcely less objectionable. If a fluctuating toll be intended, it would be as inadmissible as to propose a similar mode of charging for fast coaches, and would be open to all the cavil and interruptions to which a fluctuating toll on weight would be liable. If the toll were fixed according to the number of passengers the carriage were capable of conveying, it would imply the necessity of a license limiting the number of passengers, and cramping the progress of improvement of a machine, the capabilities of which can only be ascertained slowly and by continued experiment.

"It must be also recollected that these carriages will probably have to travel for a long period without passengers, until by their punctuality and safety they shall have induced the public to venture in them. Nor is this probability weakened by the immense number of passengers who commenced using the locomotive carriages on the Manchester and Liverpool rail-way immediately after their introduction: these engines were established among a population accustomed to machinery and steam, and therefore not entertaining the same apprehensions of its danger which will require to be surmounted elsewhere.

"The trustees of the Liverpool and Prescot road have already obtained the sanction of the legislature to charge the monstrous toll of 1s. 6d. per 'horse-power,' as if it were a national object to prevent the possibility of such engines being used. Besides, they have supplied no standard of their own conception of horse power. Engineers have differed very much in their estimates of this power; there is not, therefore, much probability that the opposite interests of a steam coach proprietor and toll collector would lead to any agreement as to the meaning of the term. But suppose the legislature were to settle this point, and to arrange that a certain length of stroke and diameter of cylinder should represent a certain power, we still fail to ascertain that which alone it is essential to know, viz. the actual efficiency of the engine. Can we regulate the density of steam at which an engine of a given size should be worked? To be effectual, it would be also necessary to ascertain the quantity of water consumed, and even this check would be inadequate with an engine on Mr. Trevithick's principle. If the toll be left as at present on 'horse power,' it would be the obvious interest of the proprietor to work with the smallest nominal power, but to increase as much as possible the force of his steam, thereby increasing the probability of explosion.

"Some trustees have placed the toll upon the number of wheels. The committee would object to this mode of charge, if only because it interferes between

the rival modes of steam travelling, and gives a bounty in favour of that in which the engine is placed on the same carriage with the passengers. The opposite plan of separating the engine from the carriage is that which probably the public will prefer, until the safety of the mode of conveyance shall have been fully ascertained.

"There is still a more serious objection to this mode of charge: it tends to discourage the use of separate carriages; although it must be evident that if a certain weight be carried it will be much less injurious to the road when divided over eight wheels, than when carried on only four. On this point the committee must again refer to Mr. Macneil's evidence. They cannot, therefore, recommend the house to adopt a scale of toll which shall increase in inverse proportion to the injury done to the road. It will be seen in Mr. M'Adam's evidence, that the toll on steam coaches imposed by the metropolitan roads act, is liable to this objection.

"Some of the local acts have placed an unvarying toll on steam carriages. This, if moderate, would be unobjectionable; but the committee could not propose any sum which would adapt itself to the necessary varieties of expense in keeping up different roads, by which the tolls on common carriages have been regulated. A fixed toll has, too, this disadvantage: that light experimental carriages, or such as are built solely for speed, would be liable to the same toll as steam carriages heavily laden.

"The committee feel that, however strong their conviction may be of the comparatively small injury which properly constructed steam carriages will do to the roads, yet this conviction is founded more on theory, and perhaps what may be considered as interested evidence, than practical experience; they would therefore recommend that the house should not make, at present, any permanent regulations in favour of steam. The experience which will be gained in a very few years, will enable the legislature to form a more correct judgment of the effect of steam carriages on roads than can be now made. They therefore recommend that the *tolls* imposed on steam carriages by local acts, where they shall be unfavourable to steam, shall be suspended during *three years;* and that, in lieu thereof, the trustees shall be permitted to charge toll according to the rate to which the committee have agreed.

"The house will have perceived, in the former part of this report, that there are two modes of applying steam in lieu of horses in draught: one, where the engine and passengers are on the same carriage; the other where the engine is placed on separate wheels, and is merely used to propel or draw the carriage. Although the difference of weight may be in favour of the former mode, yet, as on the latter it is divided over eight wheels instead of four, its small excess cannot justify a larger toll being imposed, as it will be found much less injurious to the roads. The committee therefore recommend that, in charging toll, the engine carriage and carriage drawn shall be considered but as one.

"As it is the opinion of all the engineers examined, that the use of narrow wheels has been the great cause of the wear of roads, and that cylindrical wheels of certain width of tire, are not only the least injurious, but that, in some states of the road, they may be even beneficial, the committee recommend that the wheels of the engine carriage should be required to be cylindrical, and of not less than three and a half inches width of tire. No proprietor of steam carriages has expressed the slightest fear of any inconvenience or loss from the use of such wheels. Beyond this, the committee would not recommend interference with the breadth of tire, or form of wheels: it should be left to the proprietors freely to select the breadth of tire they shall find most convenient in proportion to the weight carried.

"The committee have divided steam carriages (intended for passengers) into two classes, to be subject to different rates of toll. The first, where the carriage is not plying for hire, or where, if plying for hire, it shall not be calculated for, or carry at any time, more than six passengers. The original cost of such machines, and the expense of working them, will sufficiently protect the

roads from any great number of merely experimental carriages; and for the same reason they will not be of a weight or size likely to be injurious. A steam carriage only calculated to convey six passengers, will be solely used where great speed is required, and will be so light as to cause very little wear of the road, probably much less than many carriages drawn by the number of horses which the committee recommend as the standard of charge for this class. The toll, therefore, proposed to be placed on this class of steam carriages, is that which (on the several roads where they may be used) is charged on a carriage drawn by two horses.

"In the second class, they have placed all other steam carriages, except those travelling at slow rates, for goods only: carriages of this class should pay the same toll as may be charged on a coach drawn by four horses. This may at first appear unjust from the supposed power of steam to draw almost unlimited weight. The committee have already enumerated the difficulties hitherto encountered in attempting to propel very heavy loads on turnpike roads. They are such as to discourage the expectation that, within any short period of time, the system will have been so perfected as to give rise to inconvenience from this source; should any hereafter be found it will then be sufficient to remedy the defect. Until a due proportion of the parts of the machinery shall have been ascertained, the makers of these carriages will vary but cautiously from the models at present in use: their object will be, for some time, the perfecting of them, rather than the uncertain experiment of increasing their size.

"The committee do not anticipate that, for a considerable period, steam will be used as a propelling power on common roads for heavy wagons. It appears to have been the general opinion of the witnesses, that, in proportion as the velocity of travelling by steam on common roads is diminished, the advantages of steam over horse power are lost. The efficiency of horses in draught is rapidly diminished as their speed is increased; while, on the contrary, the weight which could be carried or propelled at any great velocity by steam, could not be more cheaply conveyed were the speed decreased to that of the slowest wagon.

"As speed, therefore, is the cause of greatly increased expense where horses are used, while with steam it is comparatively unimportant, it is probable that the latter will be chiefly resorted to when rapidity of conveyance is required. Mr. Gurney considers, that, under four miles per hour, horses can be used in draught more economically than steam. Should it, however, be deemed profitable to convey heavy goods by steam carriages, the committee recommend that there should be as little interference as possible with the number of carts employed; as the effect on the surface of roads would be infinitely more injurious if heavy loads were placed on a single cart, than if the same weight were divided over several. The committee recommend, that where carriages, containing heavy goods alone, are propelled by steam, the weight of the load should be charged, without reference to the number of carts on which it may be carried.

"As a horse is able to draw from twenty to forty cwt. on common roads, they propose that each twenty cwt. of load, conveyed in, or drawn by a steam carriage, should be chargeable at the same rate of toll as one horse drawing a cart.

"A charge on weight is not so objectionable where goods are conveyed at a slow rate, as when speed is alone required.

"In conclusion, the committee submit the following summary of the evidence given by the several witnesses, as to the progress made in the application of steam to the purposes of draught on common roads.

"Sufficient evidence has been adduced to convince your committee—

"1. That carriages can be propelled by steam on common roads at an average rate of ten miles per hour.

"2. That at this rate they have conveyed upwards of fourteen passengers.

"3. That their weight, including engine, fuel, water and attendants, may be under three tons.

"4. That they can ascend and descend hills of considerable inclination with facility and safety.

"5. That they are perfectly safe for passengers.

"6. That they are not (or need not be, if properly constructed) nuisances to the public.

"7. That they will become a speedier and cheaper mode of conveyance than carriages drawn by horses.

"8. That as they admit of greater breadth of tire than other carriages, and as the roads are not acted on so injuriously as by the feet of horses in common draught, such carriages will cause less wear of roads than coaches drawn by horses.

"9. That rates of toll have been imposed on steam carriages, which would prohibit their being used on several lines of road, were such charges permitted to remain unaltered."

The following bill, introduced in accordance with the views expressed in the foregoing report is extracted from the Mechanics' Magazine for March last.

Bill to regulate the Turnpike Toll on Steam Carriages.

"Whereas, of late years there has been invented an application of the power derived from steam to the propelling of carriages along the roads of this kingdom, and such invention is likely to become very beneficial to the public: And whereas in the absence of a just knowledge of the effect produced upon roads by carriages so propelled, and under a notion that such carriages would be more detrimental to the roads, and occasion greater inconvenience to travellers, than other carriages drawn by horses, various local acts of Parliament have been passed, imposing excessive tolls upon carriages propelled by steam or other elemental or mechanical power, amounting in some instances to a prohibition of the use of the said invention: And whereas the greater number of all the other acts of parliament whereunder tolls upon the roads and bridges of the united kingdom are collected, were passed before the said discovery was made, and by such acts no toll is imposed on any carriage so propelled as aforesaid; nor until such several acts shall be amended, or a provision in regard to the said insufficiency of such acts shall otherwise be made by parliament, can any tolls whatsoever upon carriages so propelled along the several roads or over the bridges to which such acts respectively relate be lawfully demanded; whereby in such instances the proprietors of carriages so propelled avoid contributing their fair proportion of the expense of maintaining the said roads and bridges: And whereas the public ought not to be so precluded from benefitting by the said invention, and all such legislative obstructions to the further improvement of this application of steam, and to a free and extensive adoption of it, should for a limited time be suspended; and also, throughout the realm a reasonable toll should be paid in respect of every carriage so propelled along the said roads or over the said bridges;—be it therefore enacted, by the king's most excellent majesty, by and with the advice and consent of the lords, spiritual and temporal, and commons, in this present parliament assembled, and by the authority of the same, That throughout the united kingdom of Great Britain and Ireland, from and after the *first day of July next following the passing of this act*, all and every toll and tolls imposed by any turnpike or other act of parliament whatsoever upon any carriage propelled by any means or power other than animal power, by whatsoever name or description such carriage shall be called or known, shall cease during the continuance of this act, and not be collected.

"And be it further enacted, that from and after the day aforesaid, the tolls mentioned and set forth in the schedule to this act annexed, and no other tolls whatsoever shall be collected or taken on any carriage, by what name or description whatsoever the same shall be called or known, which shall be pro-

pelled by means of steam or other elemental or mechanical power, or by any power other than animal power, along any road or over any bridge whatsoever, in any part of the united kingdom. Provided always, that nothing in this act shall authorize any such toll to be collected in respect of any carriage so propelled along any such road or over any such bridge, unless and during such time only, and at such place or places only, as tolls upon carriages drawn by horses, whether such carriages drawn by horses shall be coaches, stage-coaches, chaises, post chaises, wagons, carts, or carriages of other names or descriptions, along such road or over such bridge, shall by law be receivable.

"And be it further enacted, that where the tolls on carriages drawn by horses shall expire, or otherwise be no longer receivable, there also the aforesaid tolls on propelled carriages shall likewise cease, and be no longer receivable.

"And be it enacted, that no toll shall be collected upon any propelled carriage, which carriage shall belong to or be in the employment of his majesty or any of the royal family, or being employed in conveying the mails or king's stores, or officers or men in the army, including yeomanry and volunteers, or the navy on service, or in carrying agricultural produce to or from market or sale, or in taking persons to or from church, or a funeral, or a county election, or on carrying the surveyor of the road, or in the transmission of vagrants.

"And be it further enacted, that if after the commencement of this act, any toll-taker or other person shall take or shall demand any toll upon any carriage so propelled, other than the toll imposed by this act, he shall for every toll so taken or so demanded forfeit and pay the sum of *five pounds*, one half thereof to our lord the king, and the other half to him that will sue for the same, to be recovered in an action of debt in any court of record in the united kingdom, with full costs of suit. Provided always, that such action shall be commenced within *ninety* days after the day of taking such toll.

And be it further enacted, that this act shall commence from *twelve* of the clock at noon of the *first day of July* next, and shall continue in force from that day during *five years*, and to the end of the then next session of parliament."

Schedule of Tolls payable on Steam Carriages, or Carriages propelled by any means other than Animal Power.

"Where any such carriage is not plying for hire, or if plying for hire shall carry not more than *six* passengers, the like toll as shall be payable in respect of a four-wheeled coach drawn by two horses; and if carrying a greater number of passengers than *six*, the like toll as shall be payable in respect of a four-wheeled coach drawn by four horses.

"And when the tire of the wheels of such carriage shall be less than three inches and a half in width, or have a greater degree of convexity than half an inch; the toll to be taken on such carriage shall be *double* the aforesaid tolls respectively.

"Where any such propelled carriage shall be used in the place of a wagon or cart for conveying goods or other things, and the load shall not exceed *one ton of twenty hundred weight*, the like toll as shall be payable for a single horse drawing a cart; and for every further ton or fraction of a ton, a further toll of the like amount.

"And where the engine carriage shall be a separate carriage from the first train-carriage conveying passengers or goods, the engine carriage shall not be charged separately, but one toll only shall be taken for both carriages.

"And where the engine carriage shall draw more than one train carriage, then for every train carriage after the first train carriage, a further toll of *one half* of the single toll shall be taken, and no more."

[TO BE CONTINUED.]

TRANSLATIONS FROM FOREIGN JOURNALS.

[Translated for this Journal.*]

On the Bleaching Powers of Alkaline Chlorides.

Welter found that the liquid resulting from the absorption of a certain bulk of chlorine, by an alkaline solution, possessed the same bleaching power as the chlorine itself. This is true of the bleaching effects, as shown by a solution of sulphate of indigo; the chlorine being disengaged from the solution which has absorbed it. The same is not true of the bleaching effects upon solutions which are not acid. I made a solution of a known volume of chlorine in water, and of the same volume in a weak solution of carbonate of soda. The bleaching effects of these two solutions appeared to be the same by the test of sulphate of indigo. With colouring matter containing no acid, the alkaline solution always proved the less powerful. The bleaching power of the solution of any chloride, is much increased by adding an acid, which confirms the above remarks.

By using a solution of ink, which was not acid, I found the relative bleaching powers of chlorine and of chloride of soda, to be as 1.62 to 1. The colouring matter from the petals of the red poppy, gave a ratio of 1.66 to 1.

It should be observed that when a chloride has produced its appropriate effects, the action of an acid cannot increase them.

I will not leave this subject without observing first, that the bleaching power of a chloride as usually determined, is not that of the chloride itself, but of the chlorine used in producing it. Second, that the presence of an acid augments the bleaching powers of a chloride. These remarks may serve to explain certain facts observed in the bleaching, &c. of printed stuffs. (Soubeiran, Recherches sur quelques combinaisons de chlore.)

[*Ann. de Chim. et Phys. Oct.*, 1831.

Royal Ordinances of France relating to Steam-Boats.

(Continued from p. 110.)

I. Of the Superintendence and Management of the Engine.

1. The *permit* of navigation is to be granted only on the express condition that on board of every boat, intended for the reception of passengers, there shall be a person whose constant business it shall be to superintend the engine, and who must have sufficient skill to keep it always in order, to know when it works well in all its parts, and, if needed, to repair it.

2. The duties of this engineer cannot be entrusted to the fireman, who is to be under the direction of the engineer.

3. The engineer must observe all the ordinary measures of precaution prescribed by the ministerial instructions of 19th March,

* By request of the Committee on Publications.

1824; and to this end, these instructions ought to be hung up near the engine.

II. Of the Supply of Water within the Boiler.

4. To enable the engineer to determine that the supply of water to the boiler is sufficient to compensate for the water used in producing steam, for working the engine or to supply waste, and that thus the surface of the water in the boiler is kept at a constant level above the flues within; two gauge tubes of glass must be adapted (besides the ordinary floats) to the boiler, and must be constantly kept in a sound condition. In the adjustment of these tubes, regard must be had to the effects of dilatation by heat.

Each of these tubes is to be fitted vertically between two horizontal copper tubes, which are provided with stop cocks, and which communicate with the interior of the boiler, one above and the other below the water line, so that the water will stand at the same height in the glass tubes as in the boiler.

Several of these tubes must be kept at hand, so that if those on the boiler should be broken, they may, immediately, be replaced.

The same purpose may be answered by three gauge cocks, which must be placed thus: the first, at the ordinary level of the water, the second a little above, and the third a little below the same. But the use of glass tubes is to be preferred in river navigation.

5. A safety tube, terminated by an organ pipe, should be adjusted to the boiler, and so disposed that if, from any unforeseen cause, the surface of the water in the boiler should fall below the proper level, the steam escaping through this pipe would produce a noise, giving notice of the danger and the necessity of instantly remedying it.*

III. Of the Safety Valves.

6. The engineer ought to be careful that the safety valves are in good order.

7. The safety valves of high pressure engines must be loaded by means of a lever, those of low pressure engines directly.

Overloading the safety valves is expressly prohibited.

8. The weight on the safety valve is to be determined in pounds and fractions of a pound according to the number of the stamp of the boiler.

If the boiler be a low pressure one, and terminated with plane ends, (in which case, not having been proved, it cannot be stamped,) the safety valves must be loaded directly, with a weight equivalent at most to half an atmosphere, that is, with a weight of seven and a half pounds to every square inch.

IV. Of the Fusible Metallic Plates.

9. It is expressly forbidden to use metallic plates not corresponding

* The reader will perceive that several of these regulations could not be applied, in practice, to the boilers of high pressure engines, working at the pressure used in this country.—Trans.

in their fusing point to the number on the stamp of the boiler, or to endeavour, by any means whatever, to prevent the fusion of the plates.

10. Covers are ordered to be placed over the plates (not, however, to be fastened down) which will preserve them from injury, and prevent the acces of water or any foreign substance; at the same time, inspection must be easy, that the number of their stamp may be made out at first sight.

11. A number of metallic plates must be kept constantly on hand in every boat, so that those which may melt may be instantly replaced.

V. *Of the Steam Gauges.*

12. A mercurial gauge must be adapted to every boiler. It must be constructed with care, and graduated with exactness.

13. An open gauge must always be used for low pressure boilers, and as far as possible for high pressure boilers also. This gauge is much to be preferred to the short gauge closed at top and containing a column of air.

14. The necessary precautions should be used to preserve this instrument from injury; but there must always be at hand a gauge, beside the one on the boiler, to take the place of the latter in case of accident.

VI. *Of the management of the Fire and of the Engine.*

15. The engineer must see that the fireman manages the fire with the greatest regularity, and observes all the precautions pointed out in the ministerial instructions of 19th March, 1824, which must, for this purpose, be hung up somewhere near the engine, as has been already directed.

16. When the boat approaches a stopping place, the captain must give notice of the fact to the engineer and the fireman, that the latter may cease to urge the fire.

If, when the boat is not in motion, the column of mercury in the steam gauge should continue to rise, the engineer must let off the steam.

17. If the level of the water within the boiler should be depressed too much, and the boiler become red hot in parts, the engine must be stopped to introduce water into the boiler, and the steam should be allowed to escape only through the safety valve, or through a discharge cock.

In such a case it will be necessary to put out the fire, and allow the boiler to cool down, before water is introduced.

VII. *Of the Internal Police of Steam-boats.*

18. Captains are expressly forbidden to run their boats at a speed greater than that given by the regular working pressure of the engine, under penalty of being personally responsible for any accident which may occur in consequence of such conduct.

19. There shall be kept open, in every steam-boat, a register, the contents of which shall be examined by the local authorities and transferred to their notes. Upon this register the passengers shall have an opportunity to note their observations in relation to the going of the boat, and to accidents, if any, which may have occurred.

20. These registers shall be submitted for inspection to the committees of superintendence, whenever they visit the boat; and to the authorities charged with local arrangements in the communes situated along the water course, whenever these authorities wish to see them.

21. In every house for the reception of passengers, there should be hung up a notice, on which should be stated:

1st. The mean duration of the passage, both in going up and coming down, allowance being made for the current.

2nd. The time that the boat is to remain at the landing places.

3d. The greatest number of passengers the boat may carry.

4th. The right which passengers have to note their observations on the register opened for that purpose in the boat.

22. Captains are bound, after each trip, to declare to the local authorities all the facts which come to their knowledge, likely to be of interest to the safety of the navigation, so that measures may be taken, if necessary, in relation to them.

23. Lastly, the local regulations should specify the working pressure of every engine, the number of the stamp on the boiler, the proper load for the safety valves, the melting points of the fusible plates used, and the height of the mercury in the gauge, corresponding to the ordinary working pressure.

Said regulations must also embrace all the measures of local interest which the Prefects think proper to prescribe for the regulation of steam navigation; they must also contain an enumeration of the cases in which the *permit* of navigation may on account of violation of the regulations, be withdrawn, for a longer or shorter time. They should mention, also, that according to articles 319 and 320, of the penal code, the proprietors of boats are liable to criminal prosecution for accidents which may have arisen from their negligence, imprudence, or want of attention to the regulations, and that too without prejudice to the damages which they may have incurred.

The observance of the regulations imposed on the proprietors of steam-boats should be carefully attended to, not only by the committees of superintendence, but also by the engineers of mines, government civil engineers, officers of the ports, mayors, and adjuncts, commissaries of police and officers and sub-officers of gendarmerie, in the cities and communes situated on the lines of navigation.

It is the duty of officers in their several stations to report to the Prefects all infractions of regulations, and all accidents.

On the receipt of such reports, the Prefect having first examined into the charges contained in them, shall take such measures as he thinks proper to bring the offenders to justice.

If it happen that an infraction occurs in a different department from that in which the *permit* of navigation was granted, the Prefect

of the former department shall transmit the charges to his colleague in the department where the permit was granted, to be acted upon by the latter.

It is of importance that the visits of the committee of superintendence be made very frequently, and not only when the boats are *at the wharf*, but also when they are on the passage. The report of each visit should state the nature of the inspection made and its results.

Observations should be made especially in relation to the load and play of the safety valves, the play of the float, the condition of the fusible plates, of the stamps, and of the gauges, the condition of the gauge cocks, or of the tubes for showing the level of the water, the state of the flues and of the furnace; also in relation to the degree of regularity with which the heat is applied, and the feeding of the boiler kept up; in relation to the due strength of the boiler and boiler tubes, and their state with respect to interior cleanliness, &c., to the leakage of the boiler; its influence on the working of the engine, to the regularity of the play of the engine, to the more or less favourable location of the boiler in reference to the boat, and to the degree of exactness with which the local regulations imposed by the permit of navigation are executed.

When the committee of superintendence have reason to suppose that any low pressure boiler with plane ends is not of sufficient strength, they should require the proper alteration to be made in presence of the Prefect.

If the suspected boiler be of such a form that it can be proved by the hydraulic press, the committee must order a proof by that machine, and be present during the trial. The pressure employed for this proof must be equal to that to which the boiler was subjected at the time of its being stamped.

In this case, as in that of the original trial, the proprietor of the boat is bound to furnish the press and the manual assistance required. There is no objection to the proprietor of the boat furnishing, instead of the ordinary trial press, a forcing pump, such as the feeding pump of his engine, provided it be easy to use, and sufficiently powerful. It is hardly necessary to add that the proof ought to be repeated every time that it is judged necessary for the perfect security of the boat.

Finally, besides their opinion upon the proper measures in relation to boilers which they suspect to be wanting in strength, the committees of superintendence should add to the report of each visit every suggestion which the exigency of the case, or the good of the service, may seem to call for. They should never lose sight of the fact that it is their duty to originate as well as to execute.

(Signed,) BARON CAPELLE,
Minister of Public Works.

Paris, 27 *May*, 1830.

New table of the elastic force of steam, and the corresponding temperatures; deduced from *experiment*, from one to twenty-four atmospheres, and *calculated* for the remainder.

Elastic force of steam, taking the pressure of the atmosphere as unity.	Height of the column of mercury at 32° Fah. corresponding to the elastic force of the steam.	Corresponding temperature expressed in degrees of Fahrenheit's thermometer.	Pressure exerted of the steam on a square inch of surface of the boiler or safety valve.
Atmospheres.	Inches.	Degrees.	Pounds.
1	30	212.0	15
1½	45	234.0	22.5
2	60	250.5	30
2½	75	263.8	37.5
3	90	275.2	45
3½	105	285.1	52.5
4	120	293.7	60
4½	135	300.3	67.5
5	150	307.5	75
5½	165	314.2	82.5
6	180	320.4	90
6½	195	326.3	97.5
7	210	331.7	105
7½	225	336.9	112.5
8	240	341.8	120
9	270	350.8	135
10	300	358.9	150
11	330	366.9	165
12	360	374.0	180
13	390	380.7	195
14	420	386.9	210
15	450	392.9	225
16	480	398.5	240
17	510	403.8	255
18	540	408.9	270
19	570	413.8	285
20	600	418.5	300
21	630	423.0	315
22	660	427.3	330
23	690	431.4	345
24	720	435.6	360
25	750	439.3	375
30	900	457.2	450
35	1050	472.7	525
40	1200	486.6	600
45	1350	499.1	675
50	1500	510.6	750

* The temperatures corresponding to 4½, 5, 8, 11, 19 and 45 atmospheres are given erroneously in the table which was copied into this journal (p. 137, vol. vi.) from an English periodical.

TRANS.

On Indelible Inks for Writing on Paper.

The Committee having examined the different kinds of liquid indelible inks, are of opinion that they cannot safely be used; that the solid parts tend to separate from the liquids, and that thus time destroys the ink before use: to this defect purchasers must always be exposed. They are of opinion that solid inks offer great advantages. They consider India ink to rank first among them. The peculiar composition of this ink is not entirely known; but as imported it is a common and cheap article, so uniformly good in its quality, that, all circumstances considered, it cannot be made from a private receipt, but must be made according to one commonly known. This ink has one defect, that of not sinking into well sized paper; its good qualities are, indestructibility by age, and by chemical reagents.

The European imitation of India ink is made from lamp black, glue, and gum. Although inferior to the genuine ink, its characters are similar to those of the imported article. The ink used by the ancients was of this sort. These inks penetrate paper less readily than the India ink.

The Committee offer the following receipts for indelible writing inks:

First Receipt.—Dilute muriatic acid until it has the specific gravity of 1.01 ($1\frac{1}{2}°$ Baumé.) Use this liquid instead of water in mixing India ink.

The ink runs more readily when diluted acid is used than when water alone is employed. It is flowing, and penetrates the paper.

Second Receipt.—To a solution of acetate of manganese of the specific gravity of 1.07 (10° Baumé,) add one ninth of its bulk of acetic acid (vinegar,) of such a strength that 100 parts will saturate 160 parts of crystallized carbonate of soda. Use this liquid to rub India ink. To render this ink indelible, expose the writing to the action of ammoniacal gas, by holding it over a solution of ammonia. This ink has the advantage over the first of not exposing the paper to acid reaction, the method of using it is, however, not so simple. [Report of a Committee* of the Academy of Sciences of Paris.]

[*Ann. de Chim. and Phys. Sept.*, 1831.

On the use of particular kinds of Paper, for preventing the removal of Writing, &c.

Colouring matters which, placed upon paper, would prevent the removal of ink, must be changed by all reagents which would destroy common ink. Such matters are usually destroyed by air and light, and may be affected by substances accidentally brought in contact with them.

* Gay Lussac, Dulong, Chaptal, Deyeux, Thenard, D'Arcet, Chevreul, and Serullas.

Notwithstanding such objections, paper of this kind may be useful. For example, the paper proposed by M. Contin, may be of great use in ordinary business transactions, particularly that covered with delicate and regular designs; even the tinted paper proposed for larger documents may be used with advantage.

We should in all cases prefer the use of an indelible ink.

[*Ibid.*

Sulphate of Copper in Bread.

In examining the subject of the use of sulphate of copper in preparing bread, M. Sarzeau has endeavoured to ascertain some method by which the copper always found in grain, may be distinguished from that in the sulphate of copper, which may be used in preparing bread, and also what proportion of the latter salt renders bread *poisonous.* The results of his experiments, those relating to the noxious qualities having been made upon himself, are as follow:

1. Whenever the ashes of bread give copper by the action of the blow-pipe, copper has been used in making the bread.
2. When the liquid resulting from mixture of the ashes of the bread with water, gives a red shade to the ferrocyanate of potassa, the bread has noxious qualities.
3. If the sulphate of copper used is $\frac{1}{5625}$th part, by weight, of the flour used in making the bread, the poisonous qualities will be decidedly felt. [*Journal de Pharmacie for April,* 1832.

B.

Original experiments on the Adhesion of Valves, or Disks, operated on by Diverging Streams of Compressed Air. By Mr. T. Hopkins.

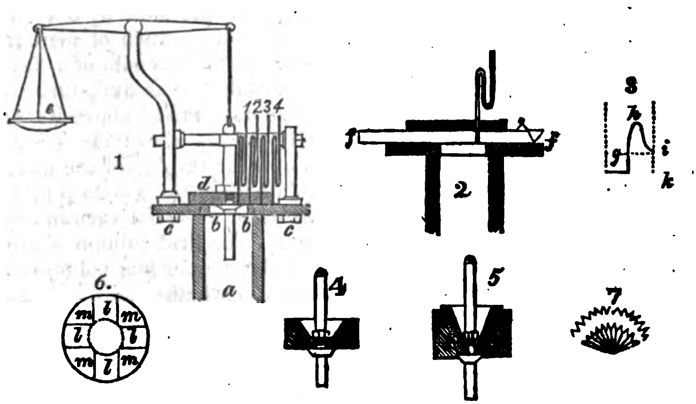
From the Transactions of the Literary and Philosophical Society of Manchester.

On the 11th of October, 1824, Mr. Roberts affixed a valve to the aperture of a pipe, used as a waste pipe, for the purpose of regulating or equalizing the force of a blast of air which was blowing a furnace. To his surprise, however, he found that the valve, instead of being readily blown off by a strong blast, remained at a small distance from the aperture of the pipe, and was removed to a greater distance only by a considerable exertion of the power of the hand. This singular phenomenon was witnessed by many gentlemen, members of this society, in the same week, and appeared to be viewed by them all as equally new and extraordinary.*

* It is said that Mons. Clement, of Paris, was in Manchester at this period, and that he saw the air valve adhere to the pipe, yet he afterwards, it appears, represented the discovery to have been made in France long subsequent to the time at which he saw it at Mr. Roberts' works.

Mr. Roberts made some experiments on his air valve at the time, and various theories were then suggested to account for the adherence of the valve to the pipe. It was not, however, until the month of September in the present year, that I agreed to join him in making further experiments, a part of which I now proceed to give.

A vertical section of part of the apparatus used is given in fig. 1, where *a* is a pipe, three inches diameter, with the aperture contracted to $2\frac{3}{8}$ diameter, at *b*, *b*, and surrounded by a flanch *c*, *c*, $10\frac{3}{4}$ diameter, to form a seat for a valve. On this seat was placed a circular disk or valve *d*, six inches diameter, with a pin in its centre, by means of which it was left at liberty to rise or fall freely, and kept at the same time perpendicular to the aperture.



The valve was attached to one end of a scale beam by a string, and balanced by weights placed in a scale *e*, attached to the opposite end of the beam. The valve being thus placed on the seat without any weight of its own to press downward, the stream of compressed air was admitted into the pipe *a*, when the valve *d* rose from the flange or seat *c*, 1-32nd of an inch, and there remained stationary. Thirteen ounces, avoirdupois weight, were now put into the scale *e*, which raised the valve to 1-12th of an inch above the seat. Twenty-six ounces raised it to 1-8th of an inch, and thirty-two ounces raised it to 1-4th of an inch, but any weight beyond this last caused the valve to fly abruptly off.

It thus appeared, that when the valve was raised from its seat a quarter of an inch, there was the greatest difference between the force of the issuing current of air pressing against the *under* side of the valve, and of atmospheric pressure on the *upper* side of the valve. The pressure of the atmosphere was greater than the force of the issuing stream of previously compressed air, a weight of thirty-two ounces being requisite to establish an equilibrium.

That we might ascertain what was the state of the stream of air under the valve, in different parts of it, four double syphon tubes were procured, and proper quantities of mercury being put into them,

they were inserted in holes made through the valve at certain distances from each other, as shown in fig. 1 at 1, 2, 3, 4. The inserted limbs of these tubes being thus left exposed to the action of the stream of air, the compressed air was again admitted into the pipe *a*, and the valve rose as before, 1-32nd of an inch.

The tube 1, in that part of the valve *d*, which was over the aperture *b*, had the mercury in it 1½ inches higher in the *outer* than in the inner limb, and consequently showed a pressure from the compressed air below it, above atmospheric pressure, equal to 1½ inches of mercury. The tube 2, which was near to the aperture *b*, but over the inner edge of the seat *c*, showed a rise of the mercury of 3-10ths of an inch in the *inner* limb of the tube, and consequently a pressure from the air below it *less* than atmospheric pressure by 3-10th of an inch,—or a partial vacuum of 3-10ths of an inch of mercury. The tube 3, at the same time showed a similar vacuum of 1-8th of an inch of mercury. The mercury in the tube 4 was undisturbed.

The valve with the four tubes in it was now raised above its seat from 1-32nd of an inch, until it was 1½ inches above the seat, by gradations of 1-32nd of an inch each, and the heights of the mercury in the tube were noted at each step, distinguishing by a *p* or a *v*, whether they showed pressure from below, or a partial vacuum, and thus a table of five columns was formed. The first column showed the height of the valve above the seat, and the other four columns the heights of the mercury in the four tubes, and whether they indicated pressure or vacuum.

This table showed that the pressure from the stream below, on tube 1, continued at 1½ inches of mercury, until the valve was raised from its seat to 1-16th of an inch above it; but from that elevation until it was raised to 1½ inches from the seat, the mercury showed a gradually diminishing pressure, and at that height the pressure was only 6-10ths of an inch.

Tube 2 showed its greatest degree of *vacuum* which was one and 8-10ths inches of mercury, when the valve was raised 3-32nds of an inch; from which point, as the valve was further elevated, the vacuum became less, until at a height of 3-8ths there was no vacuum,—the mercury in the two limbs of the tube being at the same level. On raising the valve from 3-8ths to 1½ inches, this tube showed an increasing *pressure* from the stream of air below, and at the least named height the pressure was 4-10ths of an inch of mercury.

The tube 3, showed its greatest degree of vacuum to be 7-20ths of an inch of mercury, and it was when the valve was up 11-32nds of an inch. As the valve was raised higher, the vacuum became less, until at the height of 1½ inches it was nothing.

In tube 4, the mercury began to show a small degree of vacuum when the valve was raised 3-32nds of an inch; when it was up half an inch the vacuum was one-fourth of an inch, being its greatest degree; from this point the vacuum diminished, and when the valve was 1½ inches high, there was very little difference in the levels of the mercury in the two limbs.

A similar course of experiments was gone through with a valve

eight inches diameter, with some small variations in the results, which were noted in another table; but the only one worth mentioning is, that while the six inch valve required a little more than thirty-two ounces in the scale *e*, to detach it from its seat, the eight inch valve required forty-eight ounces.

From a general view of the results thus obtained, it appeared that while the valve adhered to the seat, and remained at but a small distance from it, a circular stripe or flat ring of attenuated air was found between the valve and its seat, and near to the aperture *b*, the air at the same time in the parts further from the aperture becoming more dense, until close to the periphery it became nearly of atmospheric density; but as the valve was raised, the ring of the attenuated air approached the outer part or periphery of the valve.

To find the form and nature of this ring, it now appeared desirable that the different heights of mercury in the same tube, indicating degrees of vacuum should be ascertained at small and equal distances, beginning at the edge of the aperture, and proceeding along a radial line to the periphery of the valve. To accomplish this, a moveable slide was dovetailed into the valve, and in this slide was inserted the lower limb of one of the double syphon tubes with mercury in it as before, shown at fig. 2, where the tube is placed over the aperture, and indicates a pressure from the compressed air of 1½ inches of mercury.

This valve being placed on the seat, the slide *f*, *f*, was moved until the tube came over the seat, and the distance of the tube from the edge of the aperture was noted when the mercury first indicated a slight degree of vacuum. From this point the slide, and consequently the tube, was drawn outward 1-32nd of an inch, and the height of the mercury indicating vacuum again noted. In this way, by stages of 1-32nd of an inch each, the tube was drawn to the outer edge or periphery of the valve, and at the height of the mercury noted at each stage. The different heights of the mercury in all these stages, with the exact places of the tube at the times, were then marked by dots on paper, and these dots being connected by lines, we obtained the curve represented in fig. 3. In this diagram *g* shows the point at which the vacuum was first indicated, and the line from *g* to *h*, represents the increase of the degree of vacuum, until at *h*, it is 1¾ inches of mercury. From this point the reduction of the degree of vacuum is seen by the curve from *h* to *i*. The straight line *k*, a little lower down, represents the pressure which the mercury showed when the tube was over the aperture.

The valve was now raised higher from its seat, and the tube moved as before, and data obtained for the formation of other curves. When the valve was 3-16ths above the seat, the tube being placed over the aperture, showed a pressure of only one and four-tenths of an inch of mercury; but the tube being brought over the seat at a distance of 5-32nds from the edge of the aperture, showed a vacuum of one and eight-tenths of an inch of mercury. From that point proceeding outward, the vacuum became less.

These experiments showed, that until the valve was raised to a

certain height above its seat, the under side of that part of the valve which was over the aperture, was exposed to a pressure of 1¼ inches of mercury more than atmospheric pressure; and the under side of all the rest of the valve, forming an outer stripe or ring, was exposto a pressure less than atmospheric, or had a partial vacuum varying from one and eight-tenths of an inch of mercury up to atmospheric pressure. The superior pressure against the under side of the centre of the valve, must then have been counterbalanced by the inferior pressure against the under side of that portion of the valve which is nearer to the periphery,—and more than counterbalanced, for atmospheric pressure on the top of the valve was still so superior as to admit of a weight of thirty-two ounces being applied, before that pressure could be overcome and the valve raised.

Valves of various smaller sizes were now tried, and it was found that one of four and one-fourth inches diameter, was what may be called the neutral size over an aperture of two and three-eighths diameter; as, when it was balanced it would just adhere to the seat when the air was admitted, but the least weight placed in the scale raised it. Valves of any size smaller than this did not adhere to the seat, and would therefore be proper valves for such a pipe.

A conical valve was now procured, the greatest diameter of which was six inches on the upper side, and its least diameter was two and three-eighths inches, the same as the aperture, and its thickness one and a half inches. This valve being fitted into a proper seat, required as many ounces fitted to raise it from its seat as the flat six inch valve did. See fig. 4.

Another conical valve, whose greatest diameter was the same as the flat neutral valve, four and a half inches, its least diameter two and three-eighths, and its thickness three inches, was fitted like the preceding one, into a seat of equal thickness with itself. This valve, however, if less than six ounces in weight, was blown off by the blast. And thus it appeared, that a conical valve, may be less disposed to adhere to the seat than a flat valve, the diameter of the upper sides of both being the same. See fig. 5.

A phenomenon, singular in appearance, was exhibited while using these conical valves. It became necessary to fasten a seat with a hollow cone to the flanch, and, in the experiments, the issuing stream of air was made to pass between the cone and its seat. But when this seat was liberated from the flanch, and the stream of air suffered to flow, one stream rushed between the cone and the seat, and another between the seat and the flanch. And thus the seat of the cone was held in its situation by the two streams of air, without being in contact with any thing else.

During the experiments burning paper was placed on the valves, that the flame and smoke might show whether there was any atmospheric current rushing down upon it. But it was only at the periphery that the flame was drawn down, until it came in contact with the stream of air issuing from under the valve, which cut off the flame as abruptly as it could have been cut through with a knife, apparently from its force and coldness. On the valve the flame

blazed in the way in which it ordinarily does, when there is no current of air acting upon it.

In endeavouring to account for these phenomena, it appeared that the air in the aperture was projected or driven from the aperture as from a centre, in radial lines in every direction through enlarging circles, and thus became attenuated as it was thrown off from the centre, in the way that light is diminished according to its distance from its radiating point. For the purpose of ascertaining whether this was a correct view, or not, another experiment was made.

Instead of a circular valve, one of the form of a cross was used, six inches in diameter, of which fig. 6 is a plan. The centre of this cross valve just covered the aperture *b* in fig. 1, and the four arms *l*, *l*, *l*, *l*, extended to the diameter of six inches. The four angular spaces between them left on the seat of the valve were covered with pieces of wood *m*, *m*, *m*, *m*, fitted to the spaces and fastened to the valve seat, leaving the cross valve at liberty to be raised between them. By this contrivance the compressed air, on issuing from the aperture, was confined to four separate streams of equal and uniform breadth, which could not diverge, but passed under the cross until they escaped at the ends of its arms. The tubes with mercury, as in fig. 1, having been inserted in the arms showed not more than one-eighth of an inch vacuum in any part of the arms, and less towards their outer extremities; and this small vacuum probably was the result of some air making its way under the angular pieces *m*.

The cross was now raised enough to leave considerable spaces for the stream to expand from its previously compressed state, and to become rarified, but no greater attenuation was indicated by the mercury. And thus it appeared, that when there was but little space, only 1-32nd of an inch, under the circular valve for the air to be projected into, there was an attenuation, or partial vacuum of 1$\frac{3}{4}$ inches of mercury, but when the cross valve was gradually raised from 1-32nd to the height of half an inch from the seat, and when of course there was ample room for expansion, not more than 1-8th of an inch vacuum was indicated.

From these various phenomena it appeared that the vacuum under the circular valve was produced by the spreading of the air from a smaller to a larger circle, immediately after it left the aperture. For on the air being prevented from spreading by the pieces of wood *m*, fig. 6, when fastened to the seat of the valve, the vacuum nearly disappeared in the streams under the arms of the cross valve; but by attaching the angular pieces to the cross valve, and suffering both to rise together, the full vacuum of 1$\frac{3}{4}$ reappeared as with the circular valve.

When the circular valve *d*, in fig. 1, is placed on the seat, there is stagnant atmospheric air within the aperture *b*. On the condensed air being admitted into the pipe *a*, the stagnant air is put into motion, and before it can overcome the inertia of the valve, is forced between the outer parts of the valve and its seat. The air, while being thus forced is, however, compelled to diverge from a circle, whose diameter is two and three-eighths to one of a larger diameter,

and is consequently dilated and attenuated. The impulse given by the compressed air on its first admission to the stagnant air in the pipe, causes the stagnant air to commence the process, but the compressed air follows instantaneously, and through the force with which it is impelled by the original moving power, is projected under the valve, and there forced to diverge with a velocity proportioned to the amount of the projectile force.

The projectile force acting through the stream of compressed air, and the peculiarly shaped and confined space through which the air is driven, are then the causes of its dilatation, until its degree of rarity is beyond that of the atmosphere, when atmospheric pressure on the upper side of the valve preponderates.

This view will, perhaps, be illustrated by supposing the compressed air at the edge of the aperture, to be an elastic ring of two 3-8ths diameter, and that every part of this ring shall be struck with equal force from the centre, in a radiating direction to the circumference: by the time that the ring is projected to a sufficient distance to be a diameter of, say four inches, it will be stretched from a smaller to a larger circumference, and every part of the ring will be equally stretched or attenuated. A part of such a ring may be supposed to be represented in fig. 7. It is not, however, necessary that the substance projected should be elastic, for if the ring were made of lead, the effect would be the same; or if grains of sand, or small lead shot, could, in like manner, be thrown from a centre, in all directions around, it is clear that as they were removed farther from the centre, the grains or shot would be more distant from each other, or the stream of them would be more attenuated.

By a reference to the curve fig. 3, representing the degrees of vacuum, it will be seen that the circle of greatest vacuum is near to the aperture; and it may be inferred, that this fact is opposed to the theory of forced divergence, as on that theory it may be thought that we ought to have the greatest vacuum where the divergence was the greatest, and consequently near to the periphery of the valve. But it should be borne in mind, that the issuing stream of air has to overcome atmospheric resistance; and when, by diverging, it has become rarer than the atmosphere against which it is acting, the momentum requisite to keep it so is soon expended, and the stream under the outer parts of the valve not having sufficient force to overcome atmospheric resistance from without, yields to it, and is brought to common atmospheric density. If the velocities of the stream under the different parts of the valve could have been ascertained by stages of thirty-secondth parts of an inch, in the same way that the degrees of vacuum were found by the heights of the mercury, it is presumed that this point would have been established by experiment, instead of being left dependent on an inference.

The moving of the circle of greatest vacuum outwards, as the valve was elevated, does, however, exhibit evidence of the justness of the inference. When the valve was but little raised, the force of the stream was expended in diverging a part of itself, near to the aperture, but when the valve was considerably raised, the superior densi-

ty of the stream was not confined to that part immediately over the aperture, but showed itself also between the valve and a part of its seat. When it was raised half an inch, the same point *h*, which in fig. 3, shows the greatest vacuum, indicated a pressure of a quarter of an inch of mercury, while the circle of greatest vacuum, had removed farther from the aperture.

It has been suggested, that the formation of the vacuum may be accounted for from the known tendency of a compressed spring when liberated, to fly beyond the point at which it will finally settle. But this action of a spring is only one instance of the operation of a general law of nature which is applicable to all bodies. When any body, elastic or non elastic, is put in motion, its inertia causes it to continue in motion in the direction in which it has been impelled until its force is expended. The force of a liberated metallic spring is expended in the effort to overcome the tenacity of the substance of which it is composed, while the force of a cannon ball, fired into an earthen bank, is expended on the resistance presented by the earth; but it is projectile force that is expended in both instances.

In a short time after the phenomenon of the adherence of the air valve was observed by Mr. Roberts, he ascertained, by experiment, without knowing that it had been done before, that *water*, when forced through a conical pipe, with considerable velocity, will draw out other water, placed below in an open vessel, if one end of a small tube is inserted in the conical pipe, and the other end is immersed in the water, in the vessel below; thus showing that water, an inelastic fluid, produced the same effect that air did, when rushing out in a stream, confined in a peculiar manner. And at the time this paper was going to press, water was, by pressure from a column of considerable height, made to issue from a pipe with a valve placed over it, similar to what is exhibited in fig. 1, when the valve, instead of being forced off by the issuing stream of water, was found to adhere to the seat, at a small distance from it. And when the apparatus was inverted, and the valve consequently placed below the seat, upon the water being permitted to flow, the valve, instead of obeying the law of gravity and falling by its own weight, or of being driven off the force of the stream of water, adhered, with considerable firmness, to the seat.

¶ On Working Iron and Steel.

[Continued from p. 123.]

On Steel.

Steel is made by combining carbon with iron: it is done by immersing the iron in carbonaceous matter at a white heat and excluded from air, till it has imbibed enough all through. It is made to receive more or less, according to its intended use. Pure iron is not altered nor increased in hardness by sudden cooling from a red heat; but the small quantity of carbon which is combined with it to form steel, greatly increases its strength and toughness, leaving it both malleable

and ductile, and gives it that peculiarly valuable property of becoming extremely hard, if suddenly cooled from a red heat by immersion in water or by any other means. With this first dose of carbon it is called *mild steel*, because it possesses all the valuable properties of iron, with increased strength.

A larger quantity of carbon increases the hardness of the metal, and makes it more brittle when hardened by sudden cooling, and also renders it fusible; therefore it is called *cast steel*, and being less malleable, it is more difficult to work.

When steel is made without fusion, by immersing it in carbon, the process is called *cementation;* and it is called *blistered steel*, because, while the carbon is entering, it meets with oxygen, or hydrogen, or other impurities, which it causes to become gas or vapour, and this blisters the steel. There is a considerable quantity of steel brought to market with defects which appear to be the remains either of these blisters or of the weldings that follow.

Cast steel, being made by fusion, admits of an equal distribution of carbon, and of the escape of every particle of gas, vapour, or any other substance not compatible with it at so great a heat, leaving only such as can combine with it; therefore it is the only steel we can be sure of obtaining quite sound.

The question whether steel contains any thing besides carbon and iron, is chemical. A good workman only requires metal perfectly free from flaws, and quite homogeneous, and that will harden at the lowest heat; for this last test supersedes all others in proving the goodness of steel and its fitness for the best purposes.

The soundness of cast steel renders it most desirable to use; but the excess of carbon makes it too harsh, and therefore more difficult to work; but by frequent heatings and hammerings it may be reduced to the state of mild steel, the excess of carbon burning out while forging, and then it must be the best steel for general use. Yet shear steel predominates in the market, and more particularly in the various manufactured tools, probably from being cheaper. Therefore it is desirable to discover its faults, the better to cure them.

Perfectly pure iron cemented in pure carbon would probably make steel without blisters; but as in practice blisters are produced, there must still be oxygen in the iron, or some other substance that is turned into gas or vapour by the addition of carbon. Now, the blisters are mostly on the outside, but why not equally throughout? The answer is, the strength of the metal resists the assumption of the gaseous or vaporous state. Is not, then, the blistered outside purer or better steel than the centre? for though the carbon penetrates to the very centre, is it not obliged to combine with the oxide of iron and other impurities in the solid state, and remain so, the strength of the metal forbidding the change by which it would have a chance of escape? Again, if permanent gas is formed in any of the small blisters within, how is it to escape? the hammer may greatly reduce the size of such blisters; but will there not be small flaws or cavities remaining? If, in addition to this, the iron contains the bases of the earths or alkalies, or the earths themselves, these latter may be reduced by the

joint action of the carbon and iron, and then being vaporised by the heat, the metal may be blown into blisters. In this case the cavities would probably be coated and thus rendered unweldable; these flaws would then spread with the metal while working into plates or rods, and the mass, though close, would not be united.

The blistered steel must be unequally carbonised, the outside containing most; it is fitted for the market by drawing out to greater lengths by the hammer, then folding double, and welding together again; then drawing out, and again welding several times. This mixes the various parts together, and thereby distributes the carbon more equally, and condenses the metal; it is then called *shear steel*, and considered fit for use. Now, these weldings are liable to introduce flaws,—first, by imperfect union; secondly, by the carbon burning out of the surfaces that meet together, giving a stratum either of iron or of steel with less carbon; and these being softest, would give way during the extension of the steel.

Now, whether from original blisters, or similar cavities from imperfect welding, such defects do very largely accompany this steel; and it is a question, whether any process short of fusion can totally remove them. Yet long continued forging greatly improves the soundness and homogeneity.

Besides flaws, there is another defect often met with in steel, it is said to have pins; for, when filing or turning, it appears to have knots or pins in it harder than the rest of the metal. A similar defect occurs in brass, when, through the negligence of the founder, it contains iron or steel filings; also in wood with hard knots: but this evil is worst of all when it occurs in steel, which naturally is hard to work. I have met with it in all degrees, from mere harshness up to real hardness; so that while turning in the lathe, these parts would remain projecting out, and damage the tool rather than be cut away. I have filed some off, and then found their hardness nearly approach that of the file. This inequality of hardness causes the work and tool, though held by the rest, to spring away from each other, rendering it difficult to turn true. I think it is often caused by portions of the metal being over-steeled, *i. e.* so completely charged with carbon as not to soften by slow cooling. Another cause is stated by Mr. Clement, who broke the steel across these pins, having filed away the back to render it weak enough to part at the right place, when he found a cut or division, on which account he attributes the flaw and its hardness to oxide of iron, which prevented the parts from welding together; and as oxide of iron is known to be harder than steel, by its being used for polishing that substance, it most likely will cause hardness where it occurs. It would be desirable to ascertain the state of the surface of the deepest blisters, to know whether they are alloyed or oxidised, or in any way differing in their state of carbonization from the most solid parts. When such spots occur from oxygen, the adjoining parts must be iron; for there will be a gradation from oxide through iron to the steel, therefore the circumference of such a spot would be softest.

An excess of carbon renders steel harder and more brittle, there-

fore inequality is liable to occur. This is illustrated by iron hardened while casting; and of that which is intended to be soft, portions are frequently found hardened by the wet sand: these parts near the outside break with a more glassy fracture than hard steel. Good steel, hardened by plunging from a red heat in cold water, will always become soft by slow cooling from such a heat; but this hard cast iron does not: it requires burning several hours at a red heat, and must not be smothered by fuel to prevent decarbonizing, but, on the contrary, should be exposed to the current of air, that some portion of the carbon may burn out while the remainder has a tendency to equalize itself; then, if slowly cooled, it is found soft. Now, the knots or pins in steel are not softened by slow cooling, and to burn them out would spoil the steel, it having no carbon to spare but in the pins (supposing this to be the cause of their hardness); and keeping it hot in close vessels will not produce equality sufficient for any good purpose. Even cast steel is liable to long veins of harder portions than the rest. All these defects show the need of farther attention to the improvement of steel, and for this purpose two sorts of hammering are requisite.

The first should be at a forging heat, to knead the parts, and keep them moving among themselves almost like a paste; and should be continued till the different qualities are not only intimately mixed, but, if I may use the expression, really dissolved in each other, producing perfect homogeneity; for the carbon being thus spread, will discover every particle of oxygen, and (it is supposed) will expel it, and the metal will be rendered as sound as we can expect from cemented steel; for if free from oxygen and all alloys, except the carbon, there is nothing to prevent a perfect union of all the parts while under the hammer. Good steel consists of that proportion of carbon and iron which forms the strongest and toughest compound; each best portion, therefore, when brought into contact by the hammer, remains so, and resists its force the more from the greater cohesion of its particles; hence the redundant or deficient portions suffer most kneading, till they are all equalized, and the cruder impurities are either beaten out, or formed also into a homogeneal compound with the whole mass.

Having thus far obtained sound steel, it is yet by no means in a good state, being very unequal in density, and in a state of distraction—some parts close and dense, others squeezed out, and some nearly rent asunder; therefore a second hammering is necessary at a particular heat, and under circumstances as similar as possible to those described in the former part of this paper; such as recesses in the anvil, or in blocks laid thereon, suited to the shape of the steel.

For this purpose the metal is first brought as near as eligible to the size in which it will be used, and then is to be hammered in order to close and condense the metal equally and to the utmost all through, and yet leave every part in a state of rest and ease—a condition extremely essential for good springs, sword blades, musical wire, and every thing that has to vibrate, or act by its tension; for if one part is denser than another, or more at ease, the weaker parts

will have most, if not all of the play, and will soon break. And that this is not so often noticed to be the cause as it should be, is shown by the crudeness of the cure. If a spring breaks, it is frequently replaced by what is called a stronger, that is, a heavier one, losing a portion of the play, and what remains being still upon the weakest parts; so that though it may last longer, yet it ultimately breaks. This may also account for the breaking of axletrees that have appeared sound; for they are subject to such violent shocks as to require every part to yield equably; for the axiom, that the strength of the whole is only that of the weakest part, rendered less so by the weight and stiffness of the stronger parts, is as truly applicable to springs as to ships.

This second hammering is also to prepare the steel for receiving the utmost hardness, by that peculiar property which it alone possesses—namely, that of receiving a brittle hardness when suddenly cooled from a red heat; but though this hardened steel is brittle, its toughness greatly exceeds that of any other brittle substance.

It is this quality that makes it completely the *master metal*, the one by which we give shape and form to all the others, and fit almost every thing for our use. I must here observe, that this hardness cannot be given in part, it must always be given in full; and so true is this, that in a piece of steel, part of which is hard and part soft, no gradation of hardness can be detected; the soft parts adjacent to the hard ones being quite as soft as any others; indeed, so much so, that they have been thought by some to be softer than if slowly cooled. This appearance may be accounted for in the following way: Suppose a rod of well hammered steel is heated at one end for hardening, there will be a gradation of temperature from the coldest to the hottest end, and the annealing, or reduction of that hardness which it has received from the hammer, will be in proportion to the heat, consequently the rod will be softer and softer towards that end where the heat is applied. On plunging the bar into cold water, that portion which had become hot enough to harden becomes quite hard, and close adjacent to it will be found that part which having been the most annealed, will bear twisting and bending more than any other. But though this hardness must always be given in full, it can be let down in any assignable degree; that is, a portion of its brittleness may be removed by a moderate heat, and a greater portion by more heat, and so on, as the purposes may require. This is called *tempering;* and if hard steel be brought to a red heat and suffered slowly to cool, it becomes as soft as if never hardened; it is then ready for re-working or re-hardening. This is called *softening*, and is distinguished from *annealing*, which is the same process of slow cooling but applied to steel, iron, or brass, merely to remove all mechanical condensation, whether by hammering, flatting, wire-drawing, bending, or any other work; for if metal has been altered in shape by the hammer or other work as much as it will bear without breaking, then by annealing, it will be softened, and may again be bent or altered as much more; and so on, as often as requisite. Now, as different degrees of heat remove different degrees of

condensation received from the hammer, and a white heat removes all, it is of great consequence to harden from the lowest possible heat, in order to retain as much condensation as may be; and it is a fortunate coincidence, that the greater the condensation, the lower is the heat from which steel will harden, and the stronger and tougher will it be. But should this condensed metal be once over-heated, it will no longer harden from that lower degree, but only from a heat near that to which it has been raised; its condensation, with the advantages dependent on that quality, can only be restored by re-hammering. The lowest heat at which steel is generally brought to harden is a dull red, just visible in daylight. Therefore, to be safe, a dull red, only visible in the dark, is chosen for the hammering. At this heat also it can be kept coated with carbonaceous matter, instead of having any burnt out, which is of particular consequence. For this purpose a smith's forge, in rather a darkish place, having its flat bed even with and near the anvil, is kept smothered with small fuel, the bellows being used only enough to keep the fire alive, so that the gas or smoke cannot burst into flame. The several pieces of steel are laid a little in the half-kindled fuel, enveloped in smoke; this coats them with carbonaceous matter, which the hammering heat can hardly dispel. They are brought in succession from the fire to the hammer, and back again to the fire when too cool; the hammer moves quick, and every part of the steel in close succession is slowly passed under it, and then (the position being changed a few degrees) it is again passed under, and so on, till it has been hammered in every direction, being often reheated; and this is continued as long as the workman thinks it can be of service. Experience teaches him to know by the feel, the sound of the blows, and the lessening degree of impression, when the steel is hammered enough. By such means, and an honest zeal for the goodness of his work, Mr. Walby, whom the society in the year 1804 rewarded for his hammer, produced the best trowels that probably were ever made; their toughness, spring, and elasticity, seemed carried to the utmost. At this heat the metal spreads much less; but yet, unless confined within a recess so as entirely to prevent spreading, the outer band will be so bad as to require cutting off, it will be so stretched and rent by the pressure of the inner portion.

[TO BE CONTINUED.]

On the utility of fixing Lightning Conductors in Ships. By W. S. Harris, *Esq. Member of the Plymouth Institution.*

1. A Thunder-storm is the result of a great natural action subsisting between an extensive stratum of cloud, and a corresponding portion of the earth's surface, together with the intervening atmosphere; and is the result of some powerful agency, the nature of which is as yet undiscovered.

2. The active principle of a thunder-storm, however, may be considered as an extremely subtle species of matter, universally perva-

ding nature, and distributed in bodies, in quantities proportionate to their capacities for it, so that when accumulated in and about certain bodies, and abstracted at the same time from other bodies, a tendency to regain the previous state of proportionate distribution is marked by a certain train of phenomena; thus, a concentrated action is frequently set up between the overcharged and undercharged bodies, which produces all the effects of a violent and terrific expansive force, for the original state of proportionate distribution is often restored by a rapid explosion, at which instant the most compact bodies are broken; whilst, at the same time, there is such an evolution of heat, that substances directly in the line of action are sometimes inflamed, fused, and ignited.

3. This easy and elementary view of electrical action may not be altogether useless; for to investigate any branch of physical science with success, it is always advantageous to arrange our ideas in some determinate order, by means of which the details assume a clear and connected form; for although it must be admitted, that every theory is merely a way of picturing to ourselves the course of nature, it may be always sufficient, and admissible, so long as it is consistent with the observed phenomena, and not contradicted by any known fact.

4. In the progress of electrical inquiries, it has been found, that some substances oppose but comparatively little resistance to the passage of the electrical agency, whilst, on the contrary, other substances seem to arrest its course altogether; a fact which induced electricians to consider bodies as possessed of these peculiar properties, and to classify them in relation to this *conducting* or *non-conducting* power. Substances which oppose but comparatively little resistance to an electrical explosion, have therefore been termed *conductors*, whilst those which offer resistance to its progress, have been termed *non-conductors*, or occasionally, from the same cause, *insulators*. In the conducting class, we find all the metals, concentrated acids, water, well-burnt charcoal, wood, diluted acids, and saline fluids, most earths and stones, flame, smoke and steam. If any of these substances resting on the ground, be put into contact with an electrical machine, whilst a current of sparks is passing from it, the sparks will immediately cease; in consequence of the electric matter being transmitted by them to the earth—an easy and striking experiment. Non-conductors of electricity, or insulators, are all vitreous and resinous substances;—dry, permanently elastic fluids, such as air, baked wood, silk, pure carbon, and most precious stones, oils, dry vegetable substances, as also, dry marble, chalk, and lime, wool, hair, feathers, dry paper, parchment, and leather. If, whilst a current of sparks is passing from the electrical machine, any of these bodies be put into contact with it, and rest as in the former instance on the earth, little or no difference will be perceived, the sparks will continue.

5. Although for general purposes, the various bodies in nature may be considered as belonging to one or the other of these classes, a gradation of effect is observable from one class to the other; so that the conducting or insulating power of some substances, compared

with that of others, may be considered as imperfect: hence has arisen a third class, which consists of the remote* extremes of the other two, and which may be considered, in the power of arresting or transmitting certain electrical actions, as appertaining to either. Thus wood, hemp, stone, and the like, may become insulators to a state of low electrical action, and conductors to a high one.

6. The manner in which accumulations of atmospheric electricity proceed, may be referred to the following principle: When two substances of the conducting class are directly opposed to each other, and are separated by a substance of the non-conducting or *insulating* class, leaving the one free and the other insulated, the proportionate state of electrical distribution may become deranged to the greatest possible extent. Now, in nature, the conditions of such an experiment are found in the relative situations of the sea and clouds, and intervening air; so that when, from any cause, an evolution of natural electricity takes place, and heavy masses of vapour are present in the atmosphere, we have immediately an insulated conductor (a cloud,) directly opposed to a conductor in a free state, (the sea or land,) and an intervening non-conducting or insulating medium, the air; hence results a charged battery of enormous power: the attraction of the opposite electrical states, therefore, may become at length so powerful, that the electric matter breaks down the intervening resisting air, with a terrific and dense explosion—an effect perfectly analogous to the explosion which frequently occurs at the time of conveying a high charge to an electrical battery, and which is attended by a peculiar fracture of the interposed glass.†

7. The year 1752, which marks an important era in electrical science, from the celebrated discovery of the principle just mentioned, under the form of the Leyden jar, gave to the natural philosopher an easy method of concentrating large quantities of electricity produced by artificial means, so as to discharge it upon or through bodies with an instantaneous and violent explosion. From the time, therefore, that the cause of lightning became *identified* with that of ordinary electricity, and that the gigantic attempt of Dr. Franklin and other philosophers, of actually drawing down the matter of lightning from the clouds, was fully accomplished, the effects produced on bodies by these minor electrical discharges, with their mode of action, acquired a new interest; and many important experimental researches into the laws and operation of the great natural action, were successfully carried on by means of the ordinary artificial one.

8. Amongst the many important results arrived at by such inquiries, are the following:—

First, In every case of electrical explosion, there are universally two points of action, one *from* which the electric matter may be sup-

* Would not the term *proximate* be more appropriate than *remote*, those extremes which most nearly approach each other being manifestly intended.—Editor F. J.

† An explanation of some of the phenomena of thunder-storms on this principle will be found in my printed letter to Sir T. B. Martin, K. C. B. Comptroller of his Majesty's Navy.

posed to proceed, and another *towards* which it may be considered as determined.

Secondly, At the instant before which an explosion takes place, the stream of electricity moving to restore the equilibrium of natural disposition, seems by a wonderful influence to feel its way, and mark out as it were, in advance, the course it is about to follow; which course is *invariably determined through the line or lines of least resistance* between the points of action.

A few illustrations from experience of damage by lightning, may serve to render these facts evident.

(*a.*) The brig Belisle, of Liverpool, in November, 1811, was lying afloat, abreast of Mr. Evan's yard, at Bideford, when a vivid flash of lightning shivered her fore-top-mast and fore-mast, tore up the forecastle deck, and struck a hole through her starboard side, starting several butts in the bends, whence it passed into the sea.

(*b.*) The French ship Coquin, at anchor in the bay of Naples, was struck by lightning in the afternoon of Christmas day, 1820. The electric matter passed, in this case, close to the main hatchway, upon a spare anchor, and from thence through her bottom, a little below the water's edge on the larboard side. The boats of the squadron in Naples Bay, assisted to slip her cables and run her ashore in the mole.

(*c.*) The United States ship Amphion, Blone, master, of and thirteen days from New York, bound to Rio, was struck by lightning on the 21st of September, 1822. The lightning descended by her mizen-mast, destroyed the compasses and cabin furniture, splintered and tore to pieces the ceiling, bulk-heads, and rudder trunks, shivered two hold beams, and passed out through the quarter into the sea, tearing off part of its sheathing in its course.*

(*d.*) His Majesty's frigate Palma, commanded by Captain Worth, was struck by lightning in 1814, in the harbour of Carthagena, Spanish America. The fore-top-mast was knocked over the side, the lightning guttered or scooped its way, two inches deep, and one inch and a half wide, under the hoops of the mast, without injuring them, as far as the main deck. Here it fell upon the wet cable which had been just shortened in, and was lying against the after beam; it knocked out a piece of the beam, and passed by the wet cable out of the hawse hole, the lead of which bore evident marks of the explosion. It was perfectly calm at the time, and the lightning, besides striking the ship, *struck also down upon the sea* several times, and within a short distance of the ship.

(*e.*) The packet ship New York, in her passage from New York to Liverpool, was struck by lightning twice in the same day, April 19, 1827. The first explosion shattered the main-royal mast and mast-head, penetrated the deck, and demolished the bulk-heads and fittings in the store-rooms below,—then dividing, one part fell upon a lead tube, which it traversed as far as the side of the ship, and passed out into the sea, starting the ends of three four inch planks;

* Extracted from the log of the brig Mirabiles, and given to Mr. Lockyer, Comptroller of the Customs at Plymouth.

another portion passed into one of the cabins, and shivered to atoms the plate of a large mirror, without hurting the frame; after this, it fell upon a piano-forte, which it touched with no very delicate hand, and left it dismounted, and out of tune; from thence it passed through the whole length of the cabin floor, which was damp at the time, and out of the stern windows into the sea.

(*f.*) The operation of the second explosion was very different from this;—it fell upon a spike at the mast-head, and from thence passed down a small metallic chain, which it disjointed and partly fused, into the sea, without doing any damage to the vessel.*

(*g.*) His Majesty's ship Bellerophon, under the command of Captain Rotheram, was struck by lightning at sea, in August, 1807. A violent explosion took place in several parts of the ship at the same time; the main-top-gallant mast totally disappeared, except the heel; the rigging of it was cut and burned in pieces; main-top-mast shivered in splinters from head to heel; main-mast damaged, and thirteen feet of the fish on the fore-part disappeared. The explosion also fell on the mizen-top-mast, which it likewise shivered; it descended down the mizen-mast in a spiral direction, broke the hoops, and damaged the mast; it passed through the coat of the mizen-mast on the larboard side, and through one of the poop beams on the other side; it passed into the ward-room, into one of the officer's cabins, started the butt end of a plank in the ship's side, and split a rider underneath, on the lower deck. The electric matter on the larboard-hand went close into the ship's side, in a perpendicular direction, and through the main and lower decks; it cut the clamp of the main-deck beams, entered the steward's room, where it ripped up the tin lining, and then passed through the orlop-deck into the butter room. The vessel was not damaged in the final escape of the electric matter into the sea.

(*h.*) In January, 1830, H. M. S. Etna, under the command of Captain Lushington, was struck by lightning in the Corfu Channel, in the Adriatic, at the time of coming to anchor. In this instance three tremendous explosions came down a metallic chain, attached to the main-mast, and passed into the sea, without damage to the mast; the ship at the time seemed covered with sparks.

9. It may be observed by an attentive examination of these few cases, 1st, That the points *to* and *from* which the electric matter is eventually determined, are out of the ship; and, according with what has been stated in 1, 2, 6, are in the clouds and sea, so that the vessel is merely, as it were, an intervening object; the only action, therefore, which can be conceived to belong exclusively to the ship, is that which may be required to neutralize the opposite electrical state, induced upon the whole mass of the vessel, as being a point of the great surface opposed to the electrified clouds, and which is very small and of little consequence, compared with the capacity of the surrounding sea. Cases *a, b, c, d, e, f* more particularly show this. 2ndly, That the points through which the explosion is determined,

* This conducting chain had been set up immediately after the first explosion happened. See vol. 2, p. 63, of this journal.

are invariably in the line or lines of least resistance between the points of action—that is, through the best conductors. Cases *d*, *f*, *h*, clearly illustrate this; and the same may be traced in all the others.

10. It may be also observed in these, as in every other case of damage from lightning, more especially on shipboard, that the greatest mischief occurs where good conductors cease; the electric matter being then enabled to produce all the disastrous effects of an expansive force, as if, whilst in the conducting body, it was in a diffused and low state, and again condensed and brought into a narrow focus, at the moment of leaving it. The damage, therefore, may be in this case considered to happen, not where the best conductors *are*, but where they *are* not; so that the mariner has to contend with a constantly exploding principle, which continues its devastations in all those points where it ceases to be transmitted; thus determining for itself a passage between the points of action through such line or lines as may, upon the whole, oppose to it the least resistance.

11. Such effects being constantly observed not only on ship-board, but on shore, it became a grand question of scientific consideration, how far it would be prudent to provide for the electric matter an efficient conducting line, between the highest points of a ship and the sea, so as to offer the least resistance to the progress of such powerful agency, and transmit in a state of low tension between the points of action; on the same principle that persons, dreading an inundation, would provide a channel to carry off the water as easily as possible; an idea, as is well known, first suggested by the celebrated Dr. Franklin, and since carried into practice with considerable success; the conducting line having the name of lightning conductor or lightning rod.

[TO BE CONTINUED.]

Report on the present state of the New London Bridge. By Mr. CHRISTOPHER DAVY, *Architect.*

To the Editor of the Mechanics' Magazine.

Furnival's Inn, Feb. 27, 1832.

DEAR SIR,—Having on the 20th inst. minutely surveyed along with you the present state of the new London bridge, I now proceed, agreeably to your request, to state the result of that survey for the information of the public.

A very considerable degree of subsidence is always to be looked for in structures of this magnitude; and wherever such subsidence possesses one uniform bearing, there is little, if any thing, to be feared from it. In laying out the working plans of the new London bridge, it was inferred, from the soundings that were previously made, and from what had taken place in the case of the Southwark and Waterloo bridges, built over the same river, and at no great distance from the site of the present, that the centre arch and pier might settle nine inches, and each of the others eight inches; and Sir

John Rennie states, that the actual settlement falls short of this calculation, (Report to the corporation of London, Nov. 17, 1831.) It cannot be said, however, that the bridge has yet reached its actual bearing; neither is the real state of matters correctly represented, by speaking of the subsidence as merely vertical.

From the survey which we made, it appears clearly that a settlement has taken place in three different directions. The first is the perpendicular settlement of the bearing piers into the bed of the river. The second is a longitudinal settlement of the superstructure from south to north. The third is what may be called a transverse settlement of the entire structure from west to east, that is, sideways, in the direction of the stream.

The effect which these different subsiding tendencies has had on the form and appearance of the bridge, will be found accurately represented in the accompanying drawings.

Fig. 1.

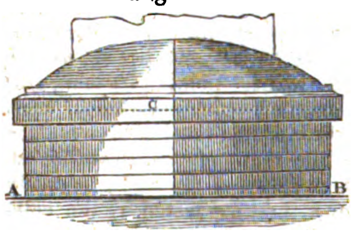


Fig. 2.

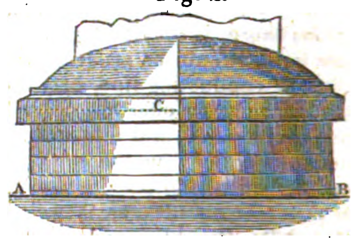


Fig. 3.

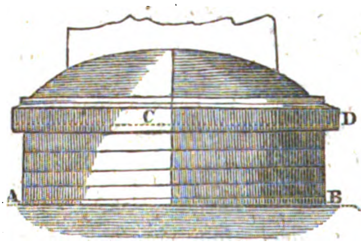
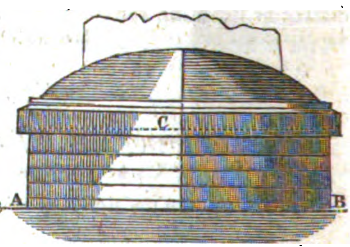


Fig. 4.



Figs. 1 to 4, represent the present elevation of the cutwaters of the different piers, beginning from the Southwark side. The dotted line, C, is a perfect horizontal line, drawn from the corner of the platband, or string course, D, of the first bearing pier on the city side, through all the others, in order to show how the piers have sunk, compared one with another. The lines A B, drawn through the different cutwaters, show how much each pier deviates from the true level. We measured accurately the height above the water (at *half* flood) of each of the first course of stones, at the points A and B, and found the following extraordinary variations:

Fig. 1.	Fig. 2.	Fig. 3.	Fig. 4.
A 4¾ inches.	5½	A 8½	6
B 5½	6½	B 6	9

The pier and cutwater, fig. 1, has evidently been the first of the series to settle downwards; and this can only be accounted for from the lesser density of the soil on the Southwark side of the river. The south bank of the Thames was originally at this place a vast marsh or swamp, while on the city side, the ground was firm, and rose somewhat abruptly from the river. In 1823, the whole of the river bed at this part was bored under the directions of Mr. Telford, by order of the Bridge-House Committee; and the borings then made, showed that the rubbish and loose soil on the Southwark side, reached considerably below the level to which the tops of the bearing piles of fig. 1 have been driven. It has been stated, indeed, by the engineer, the assistant engineers, and contractors, that "every one of the piers was founded on very hard solid clay;" nay, that a considerable thickness of it was removed to get to the depth at which the foundations were laid: (Report of Messrs. Telford and Walker, October 17, 1831,) the excavations, too, were made within coffer dams, so as scarcely to admit of any mistake about the nature of the ground; but if the soil on the south bank were not of inferior density—something far short of "very hard and solid," how is the greater sinking on that side to be explained? I am not aware of any other explanation that can possibly be given.

The piers figs. 2 and 3, being those on which the centre arch is raised, incline towards each other; and this would seem to arise from the current being much stronger, and of much greater depth in the centre of the river than towards the sides, and from a consequent leaning to the side of least support. Sir John Rennie states, that the piers are protected from the action of the stream by "three complete rows of sheeting piles, fifteen inches square, and driven 18 feet into the ground (in addition to the bearing piles,) and extending round them for a distance of thirty feet;" and, moreover, that "the bed of the river for the same distance, is three to four feet *above* the platforms, and two feet eight inches more above the heads of the bearing piles," (Report November 17, 1831.) But on the other hand, Messrs. Telford and Walker have reported that from their "soundings in the middle of the centre arch, the bed of the river at that place is now about two feet six inches under the level of the top of the platforms." (Report October 17, 1831.) We are constrained, therefore, to conclude, that since the bearing and protecting piles were driven in, the bed of the centre of the river, must have been scooped out to the depth of some six or seven feet; and this would indicate a violence in the scouring operation of the stream, which could not fail, in spite of the protecting piles, to affect very materially the solidity of the foundations, laid bare to its action. It seems probable that this result has been very much accelerated by the circumstance of the greater part of the piles which supported the centring of the middle arch, having been subsequently withdrawn, and the soil having been thus necessarily broken up and loosened to a great depth. It is deserving of remark, that in the only other bridge over the Thames in which this plan of raising the centrings was exclusively followed—namely, that of Westminster—a similar

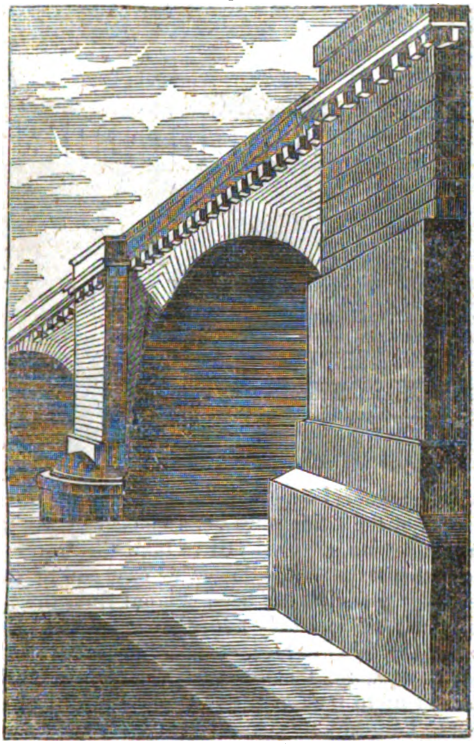
failure took place; and that, although the piles were not wholly withdrawn, but sawn off under water. The centrings of Blackfriar's and Waterloo bridges were supported on the offsets or footings of the piers. In the case of the Southwark bridge, the centrings were partly supported on the offsets of the piers, and partly on piles driven into the bed of the river—a combination of means called for by the great span of the arches; but the piles were at such a distance from the piers, that the subsequent extraction of them did little if any harm. In no circumstances, however, can the withdrawing of piles from such places, and the disturbance of the soil consequent upon it, be considered either safe or prudent; and least of all, where there is a deep and impetuous current, such as that through the centre arch of the new London bridge to contend with.

The longitudinal settlement or leaning of the superior part of the structure, from south to north, that is, from the Southwark to the city side, is a fact at seeming variance with the southward inclination of the foundations; but it may be explained in this way. The theory of equilibrium, as applied to elliptical arches, requires that an immense weight should rest upon the haunches—the line of the extrados at that part forming an asymptote with the springing. In practice this condition is considered to be fulfilled either by loading the spandrils with rubble, or by the more approved method followed in this instance, of building hance-walls upon a considerable portion of the extrados. The necessary effect, however, of the great sinking which has taken place in the first pier on the Southwark side (fig. 1) must have been to draw off this required weight from the haunches, and to make it lean backwards and longitudinally, instead of downwards. Nor can it seem surprising that the backward pressure of so vast a body of materials, combined with the natural thrust of the arch, should communicate its influence, more or less, to all the arches and piers throughout the bridge. I think I may, with great safety, venture to assert, that if the roadway of the bridge were taken up, and the extrados of the first arch on the Southwark side examined, the hance walls would be found in a very fractured state. External symptoms of such a result are even already extremely apparent. Several of the voussoirs at the shoulders of the arch—the very part which in the case we have supposed would be first affected—have fallen out of their places, and given to the curve of the intrados the tortuous appearance represented in fig. 6. It may be proper to observe, that this distortion is not readily perceptible when viewing the bridge from the water, and that it is only to be seen properly from the plying stairs on the Southwark side.

The extent of what I have called the transverse settlement—that from west to east—is represented in fig. 5, which is a section through the centre of the first arch, on the Southwark side. The line, C C, marks the varying height of the first course of stones above the water; at the west or upper end, it is eight and a half inches, and at the east, or lower end, only two inches. The dotted line A, is a correct perpendicular, showing by comparison with B, the present face of

the structure, how much it has fallen from its proper vertical position.

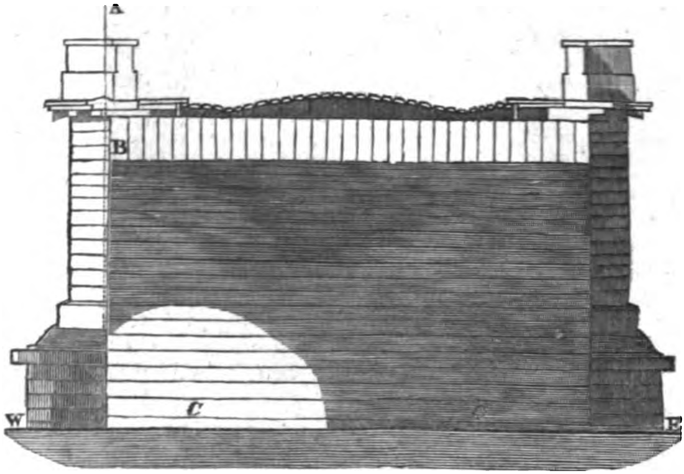
Fig. 6.



It appears, that from the first the east side of the bridge was considered to require greater support than the other; first, because of its greater proximity to the rapids at the old bridge: and, secondly, because the clay stratum was known to be several feet lower at the east than the west side. It was accordingly deemed expedient to cut off, and leave in, two rows of the coffer dam piling, in front of each cutwater on the east side, while the dam piles on the west side were withdrawn. But this precaution has been apparently of little avail; neither was it of a nature to counteract any tendency to depression, arising from insufficiency or irregularity in the foundations, or a want of equilibrium in the superstructure. As this transverse settlement is uniform throughout the bridge, and corresponds closely with the degree of dip in the clay stratum, it is difficult to resist the conclusion, that there is a connexion of dependence between them; though in what particular way the deviation from the horizontal line has been produced must ever remain matter of conjecture. It may

probably have arisen from the length of the bearing piles not having been graduated according to the dip of the strata.

Fig. 5.



The resident engineers and sub-contractors, say that this transverse settlement of the bridge has been caused by the first platform having been "laid with a small fall to take the water towards the pumps, which were fixed at the lower or east end of the first pier, and that the other piers having been set out from the first one have the same inequality;" and they add, that "the stones, after having been dressed at the Isle of Dogs, came up in pieces ready to be set, and so perfectly squared, that the variation from a level in the platform was carried up to the top of the bridge." But of this explananation, Messrs. Telford and Walker very truly observe, "it implies a difficulty of execution, which, to say the least, it is not easy to account for." "The points of the piers, the faces of the walls, and the courses of the stone work through the piers, are, with little exception, in straight lines, battering or overhanging, or sloping at the places where the irregularities are, but all nearly corresponding; that is, if the courses of stone in the piers are out of level, the ends of the piers and spandril walls to the top of the arch are nearly proportionally out of perpendicular, but still sufficiently straight, and it is not easy to suppose them to have been built so. We do not think the statement of the stones being so square, as that the work, when once begun on an inclination, naturally inclined to slope and batter to the end, without the superintendents or workmen being aware of it, sufficient to account for the irregularities to the present extent." (Report Oct. 17, 1831.)

Fortunately, the abutments at both ends of the bridge have undergone little or no variation; and should they remain firm, and the different settlements not extend much farther, no fears need be enter-

tained for the permanent stability of the structure. They will have marred its beauty, but that will be all. Were the city abutment, however, ever to fail, the fabric has such a general leaning towards that side, that it would infallibly tumble into the river.

The parapet of the bridge was not set till a considerable time after the centres were struck, and till after the settlements before described must have made considerable progress. But it exhibits, notwithstanding, very evident traces of their disturbing influence; a circumstance from which it may be inferred that *the movement* has by no means yet reached its termination. The stones appeared to us, in a great many instances, parted to a degree, which no imperfection of workmanship, or any shrinking of the mortar from the winter's frost, could possibly account for.

It is deserving of observation, that all the imperfections which have been noticed are imperfections of execution merely, and do not in the least detract from the superiority of the elliptical principle of construction. Had it been the principle that was in fault, it would have been at or near the key-stone, that we should have found failures taking place; but though we carefully examined the voussoirs and line of intrados of all the arches, we found the upper part or crown invariably firm and sound.

CHRISTOPHER DAVY.

¶ *Comparative advantages of heating by Hot Water, Hot Air, and Steam.*

From minutes of recent conversations at the Institution of Civil Engineers.

Mr. Turrel said, that where steam was employed, it was requisite that a strong heat should be kept up under the boiler, in order to have a continued flow through the pipes, for as soon as the fire fell low, the steam was condensed, and they, becoming empty, were no longer serviceable for heating. With water, on the contrary, so long as there remained the smallest heat in the boiler, that temperature would be equally distributed over the whole house; the water still continuing to circulate, until it cooled down to the temperature of the atmosphere.

Mr. Simpson said, that the method of heating rooms by warm water, possessed a decided superiority over any other, from the comparative security it afforded against accidents by fire; he had known instances of hot water pipes being introduced into bankers' houses, (where they are extremely fearful of fire,) after they had objected to the use of flues, or pipes conveying heated air, or steam.

Mr. Cottam said, that no experiments had been tried hitherto, by which could be ascertained the quantity of fuel necessary to produce a given temperature on the pipe, or in the atmosphere of a room which was heated by its means. He thought it very desirable that a statement of the relative consumption of fuel should be obtained, as, in some observations on the performance of a hot water apparatus attached to a pinery, that consideration was overlooked. He could

state one instance of a house that he had fitted up with a set of hot water pipes, by which a saving of one-third was effected in the consumption of fuel; here, however, the flue, which was in use previously, had been of faulty construction; this, therefore, ought not to be considered as decisive. He stated, that no beneficial effect was produced by leading the flue from the fire, along the brick wall; there was no apparent increase of temperature in the house.

Mr. Sibley described a hot water apparatus he had fitted up, which warms several rooms, boils a cistern, and heats a bath on the top of his house; this is managed by a boiler being placed behind the kitchen fire, and which, in fact, forms the back of the kitchen range; from this a common two inch gas pipe is conducted round the rooms to the top of the house, a height of fifty feet, and returned to the boiler. He stated, that although considerable heat must be withdrawn from the fire by this apparatus, and the consumption of fuel probably increased, yet no inconvenience was felt from its operation.

Mr. Turrell observed, that he had been in the practice for many years of heating his office with a hot air stove; it was found to create an unpleasant smell, and the atmosphere of the room eventually proved extremely hurtful to the lungs. He adopted a plan of evaporating a portion of water during the whole of the time the stove was in operation, thereby keeping up a proper degree of moisture in the atmospheric air; this removed every injurious effect which was before observable.

Mr. Field said his offices were heated by means of steam pipes, and that it created a most unpleasant smell, accompanied by a feeling of oppression on the lungs. He thought the hot water pipes preferable, on account of the greater uniformity of temperature which was afforded, and always of a very moderate degree: that from steam pipes, on the contrary, was always high, and more difficult to regulate.

Mr. Clegg had been employed to correct the unpleasant smell, created by the air in coming in contact with the red hot surfaces of iron stoves. He adopted a method of covering the stove with a kind of glazed tiles, which was found to be very effective.

Mr. Hawkins had known an instance of a cotton mill, in which it was found impracticable to spin any fine description of thread, on account of the state of the atmosphere, produced by the artificial heat. A scientific man gave as his opinion, that a deficiency of moisture affected the electrical condition of the atmosphere, and was the cause of the difficulty of working the cotton into fine thread. Mr. Hawkins was of opinion that the oppressive feeling spoken of, was more to be attributed to the circumstance of a supply of moisture being necessary for conducting the electricity from the human body than to the fact of the air being burnt or decomposed.

[*Athenæum.*

¶ *Method of Transferring Prints from Paper to Wood.*

Sir,—A method of transferring lithographic prints from paper to wood, was discovered sometime back in France; the process has been

imported into this country, and is at present extensively employed for the purpose of ornamenting white wood articles of various kinds, and forms a favourite amusement of the fair sex.

It having occurred to me that a brief description of the process might be acceptable to some of your readers, I beg leave to place the following at your disposal.

In the first place, the article on which the print is to be transferred, should receive a coat of spa—or, of the transfer varnish, allowing a sufficient time for it to become dry: this greatly facilitates and improves the transfer, and also preserves the wood from soil or stains during the process. Having cut away as much as possible of the superfluous paper from about the print, place it in a vessel of clean water until it is completely saturated, which will be in about five or ten minutes; then place it between blotting paper to remove the superabundant water from its surface. This done, with a flat camel's hair brush spread the transfer varnish* equably over the surface of the print, and apply it immediately to the wood; lay a sheet of writing paper upon it, and rub it all over with the hand, using pressure, that the necessary adhesion may take place.

With the fingers, dipped from time to time in water, peel off the paper by continued rubbing, proceeding with more caution as the print begins to appear. The rubbing and washing should be continued until the whole of the paper is removed; when dry, a coat of spa varnish will bring up the print.

If the article is to be polished, continue to apply the varnish until a sufficient body is obtained for that purpose, taking care that each coat is dry previous to the application of the next. When the whole is perfectly dry and hard, take pumice stone in an impalpable powder, and with a piece of serge moistened with water, polish until a smooth even surface is obtained. Then take the finest tripoli, and with a piece of fine cloth, and some olive oil, continue the process until a high degree of polish is obtained, when the oil must be wiped off with a soft linen cloth, and the surface cleaned off with starch powder, or with Spanish white.

It is but seldom, however, that persons polish their articles themselves, more patience and practical dexterity being requisite for the success of this process, than falls to the lot of every one; varnishing, is, therefore, a distinct occupation, performed by persons who make it their sole business, and who, therefore, attain great skill in the process.

In the above way all kinds of plain or coloured prints may be transferred to wood; but when coloured prints are used, it is necessary to employ an acid solution instead of water, to destroy the size which exists in all papers of coloured prints. For this purpose mix two-thirds of vinegar with one-third of water, and with it moisten the back only of the print, proceeding with the transfer as before directed.

* Prepared by George Gardom, and J. W. Williams, Philadelphia; and probably by other persons in most of our cities.

The transfer process bears a considerable resemblance to lithographic printing, and it is most likely that the idea was suggested by it. The *rationale* of the process is as follows: the paper being saturated with moisture, does not unite with the transfer varnish, but the ink being of a greasy texture is impervious to the water, and is therefore taken hold of by the varnish, and securely fastened to the wood; the paper not being so held is washed away with comparative ease, leaving the ink imprinted upon the wood.

W. Baddeley.

London, April 3, 1832.

[*Mech. Mag.*

New Lamp.

In the course of the first meeting, at York, of the British Association for the Advancement of Science, the Rev. Wm. Vernon Harcourt, on the 1st of October last, showed a lamp constructed upon a new principle, and explained the principle and construction of it: he gave it the name of an *oil gas lamp;* not because it was lighted by gas formed at a temperature below that of flame, (for this was common to all lamps,) but because, as in the gas lights of the streets, the gas issued from a reservoir, and owed the perfection of its combustion not to an ascending current of hot air, but to the force with which it was propelled from the reservoir and carried the air along with it. It differed from the common gas lights in these circumstances:—that the reservoir formed part of the burner; that the gas was formed as it was consumed; and that it was propelled not by a *vis a tergo*, and in a state of condensation, but by the expansive force of its own heat. In consequence of this circumstance, the current of the gaseous jet was more rapid in proportion to the quantity of matter contained in it than in the common gas lights, whilst it was also at a much higher temperature, so that it could issue with a greater velocity without being liable to blow itself out. The practical difficulty of the construction consisted in the obtaining a steady supply of oil, especially with the cheap oils. This difficulty had been in a great measure surmounted, but the instrument was still imperfect, and had been charged by some accident that evening with a vegetable oil, from which a clear light could not be obtained.*

[*First Rep. of British Asso. for Advanc. of Science.*

* At p. 188 of vol. ix. there is a description of an oil gas lamp, invented and patented by Solomon Andrews, M. D, of Perth Amboy, on the 15th of April, 1831. So far as the above article describes the "New Lamp," it appears to correspond precisely with that of Dr. Andrews. This lamp has been further improved by the inventor, who obtained an additional patent therefor on the 10th of May last. The editor has one of them in his possession which affords a brilliant and clear light, and upon which he is experimenting with a view to the testing of its comparative value, which he intends to publish at an early day.

Bone Dust for Cultivation of Grain.

The exportation of bones from Germany to England, constitutes a singular epoch in the annals of commerce. Myriads of tons have been already exported without glutting the market, or causing a cessation of the demand. In the vicinity of the North Sea mills have been erected to pulverise them. This bone powder, or bone dust, was long ago exclusively applied to the purposes of hot houses by German horticulturalists; but the English, emboldened by their riches, have extended its use to general objects of agriculture, and fertilize, by these expensive means, their cold, humid, and poorest land; and have thus brought the uplands of Nottinghamshire, the western parts of Holderness, &c. into the highest state of cultivation, both in point of extent and intenseness of fertility. There is, consequently, a proverb, "that one ton of German bone dust saves the importation of ten tons of German corn." As Malta formerly covered her naked rocks with foreign soil, so does England now fertilize her clay and sandy heaths with German bones. Near the sea coast even the church yards are robbed of their venerable relics, which is only ironically excused by rendering the German bone trade popular. An agriculturalist, being rendered attentive by this vast exportation, instituted privately some comparative experiments, the results of which prove that bone dust acts in the cultivation of grain, as compared to the best stable manure—1. In respect to the quality of corn as seven to five. 2. In respect to quantity as five to four. 3. In respect to durability of the energy of soils as three to two. It produces several collateral advantages—1. It destroys weeds. 2. It diminishes the necessity of suffering the land to lay fallow. 3. This concentrated manure, or substitute for manure, is more easy of conveyance, less laborious to spread, and can with facility be applied to the steepest vineyards or other inaccessible lands either in mountainous countries or in wet meadow land. 4. It renders agriculture practicable without cattle breeding, grazing, &c. [*Rep. Pat. Inv.*

¶ *Analysis of Maillechort.*

An alloy which resembles, pretty well, silver and polished platina, has been manufactured for some years at Paris; it evidently resembles the German silver, now extensively employed in England. M. Dumas, (Jour. de Pharm. Feb. 1832,) gives the annexed analysis, which will show that it differs not very materially from that of the German silver, given some time since in the Mechanics' Magazine.

Maillechort.		*German Silver.*	
Copper,	66.	Copper,	53.9
Zinc,	13.6	Zinc,	29.13
Nickel,	19.3	Nickel,	17.48
Iron and sulphuret of arsenic	trace		100.00
Loss,	1.1		
	100.0		

Papers on *white Copper*, which is an alloy similar to the above, will be found in the Philosophical Magazine, vol. 63, p. 119, and vol. 64, p. 73. [*Philo. Mag. April*, 1832.

¶*Expansion of Iron Pipes by Heat.*

From minutes of recent conversations at the Institution of Civil Engineers.

Instances of expansion in iron pipes of various lengths, caused by an elevation of temperature were adduced. A set of pipes at Manchester, two hundred yards long, was observed to expand to the extent of seven inches. A pipe of one hundred and eighty feet long expanded one inch and three quarters, from change of temperature. [*Athenæum.*

Meteorological Observations for July, 1832.

Moon.	Days	Therm. Sun rise	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches.				Inches.	
	1	63°	92°	30.10	30.05	68	W.	Breeze.		Light clouds.
	2	67	94	.00	29.90	62	SW.	do.		Clear day.
	3	72	92	29.90	.80	57	NNW. W.	do.		Light Clouds.
☽	4	70	90	.85	.90	55	W.	do.		Clear day.
	5	63	90	.90	.90	57	SSW. W.	do.		Clear day.
	6	73	90	.90	.90	61	SSW.	do.		Lightly cloudy—clear.
	7	70	92	.90	.80	73	SSW. W.	do.		Light cl'ds—Therm. at 12
	8	70	89	.80	.70	66	E. S.	do.		Cloudy—clear. [94
	9	63	67	.70	.65	56	E.	Calm.	.07	Cloudy—rain.
	10	64	77	.65	.65	58	W.	Breeze.		Cl'dy: fly'g cl'ds; thund.
	11	56	63	.65	.65	55	W. E	do.	1.00	Showery. [sh'w'r.
☉	12	56	71	.65	.65	52	W. N.	do.		Clear—flying clouds.
	13	58	77	.65	.65	52	W.	do.		Clear—sh'w'r—high wind
	14	57	80	.70	.80	52	W.	do.		Light clouds.
	15	58	80	.90	.90	50	W.	do.		Clear day. [shower.
	16	60	76	.90	.90	57	W.	do.	.03	Clear; overcast; thunder
	17	62	83	.94	.96	66	SSW.	do.	.01	Clear; light clouds; rain.
	18	64	89	30.00	30.00	65	W.	do.		Cloudy—clear. [high.
	19	69	81	.00	29.70	62	W.	do.	.48	Clear; thund. sh'wr. wind
	20	68	87	29.60	.60	64	W.	do.	.94	Clear day; sh'w'r. ev'n'g.
☾	21	69	89	.60	.60	56	W.	do.		Clear—flying clouds.
	22	62	80	.70	.70	54	NNW.	do.		Clear day.
	23	59	81	.90	.95	55	S.	Calm.		Clear—flying clouds.
	24	61	78	.95	.90	65	S.	do.		Cloudy—drizzle.
	25	70	82	.73	.71	51	W.	Breeze.	.04	Fly'g cl'ds. clear; lt. rain.
	26	62	76	.70	.70	55	W. N.	do.		Clear—flying clouds.
⊗	27	60	82	.86	.95	51	W.	do.		Clear day.
	28	60	80	.95	30.00	58	W.	do.		Clear—flying clouds.
	29	66	84	.90	29.90	65	S.	do.	.40	Lightly cl'dy; clear; rain
	30	65	82	.80	.80	64	W.	do.		Cloudy—clear [in night.
	31	66	83	.85	.90	63	WNW.	do.		Light clouds—cloudy.
	Mean	63.97	82.99	29.83	29.81	55.4			2.07	

		Thermometer.	Barometer.
Maximum height during the month,		94. on 7th.	30.10 on 1st.
Minimum	do. . .	56. on 11th & 12th.	29.60 on 20th and 21st.
Mean	do. . .	73.13 . .	29.82

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

OCTOBER, 1832.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Alarm to be applied to the interior Flues of Steam Boilers. *By* A. D. Bache, *Professor of Natural Philosophy and Chemistry in the University of Pennsylvania.*

Both experience and theory point out sources of danger to which boilers with interior flues are particularly liable. As economy will probably lead to the continuation of the use of these interior flues, in boilers of certain sizes, means of safety should have reference to this particular kind of boiler, now in such general use, as well as to those of a different construction.

The objects of interior flues, are well understood. They serve, more or less perfectly, to place the heated gases from the furnace in close proximity to the water of the boiler, and to retain them thus until they can no longer be used advantageously to impart heat. The form, number, and position of these flues are varied to suit the size of the boiler, or the peculiar views of the constructor.

As an example of this kind of boiler, one may be taken in which the draught, after passing under the boiler from the fire end to the back, returns through a flue, within, to the front, where it leaves the boiler. This is a favourable case for safety in this mode of construction, for the flue is not so liable to be unduly heated as when it serves, throughout its length, as a passage to flame. The construction itself, however modified, exposes peculiarly to the danger consequent upon a depression of the water within the boiler below its proper level. The flues, particularly in the small high pressure boilers in which they are

so commonly used, cannot be placed much below the habitual level of the water, and though they present convex surfaces of small diameters, a small depression in the level of the water, after the top line of the flue has been uncovered, exposes a considerable surface.* In such a case, the parts of the exposed surface not adjacent to the water line, being in contact only with steam, which conveys heat from them but slowly, become unduly heated, and, on a considerable increase of temperature, lose their tenacity. If water now obtain access to the heated metal, from any of the causes so often stated, the pressure of the steam suddenly generated must, if the boiler be, from construction or relative temperature, stronger than the flue, cause a collapse of the latter.

When several boilers are placed side by side, and communicate freely with each other, which is the case in many of the boats on our western waters, the careening of the boat,† if sufficiently long continued, as at a landing, &c. will, by partially emptying the boilers on the higher side, produce the circumstances to which we have alluded. The coincidence of such observations with the fact of the occurrence of so many explosions just after leaving landing places, is too striking to pass for accidental.

A large boiler, with flues not in the centre, would be similarly situated with those just described, under like circumstances.

In vol. vii. p. 217, of this journal, I proposed a method by which the fusible metal plate might be applied to steam-boat boilers without risking the safety of the boat, when, under peculiar circumstances, the plate should give way.‡ A plate attached to the boiler would serve only indirectly, if at all, as a means of safety to the interior flues of the kind of boiler which we are now engaged in discussing. A more direct application is wanted to meet the peculiarities of the construction. Besides, the objects to be accomplished in relation to the boiler and to the flue are different. A fusible plate applied to a boiler is intended to act in two different states of the steam within. The first is when the steam is saturated, and has,

* A depression of one inch below the top of a flue nine inches in diameter, and placed horizontally, would expose, for every inch in length of the flue, about 6.1 square inches of surface. A flue twelve inches in diameter, under the same circumstances, would expose rather more than seven square inches, for every inch in length.

For a depression of only one-fourth of an inch, the first flue would expose, for each inch in length, about three square inches, and the second between 3.4 and 3.5 square inches.

† See Williams on "obviating or lessening the accidents incident to Steam Navigation." Journal of Franklin Institute, vol. viii. Also Cadwallader Evans' communication to Committee on Explosions, Journal of Franklin Institute, p. 89, vol. ix. It is due to Mr. James J. Rush, of Philadelphia, that the fact should be known, that he presented to the Committee on Explosions, at one of their earliest meetings, a drawing exhibiting this defect, for which he proposed a remedy.

‡ Since the publication alluded to, the Society for the Encouragement of National Industry, in France, has awarded a silver medal to Edward Hall, of Paris, for an application of the fusible plate which fulfils one more condition than the method which I proposed, and is thus superior to it. I shall take occasion to communicate a description of this invention.

therefore, an elastic force corresponding to its temperature: the second, when from a deficient supply of water, the boiler becomes unduly heated, and communicating its heat to the steam within, the latter is surcharged. In the first case, the plate acts as a check upon the common safety valve and allows the escape of steam when the valve has not done its duty. In the second case, the steam should be suffered to escape only to furnish an alarm, since its continued flow would tend to increase the evil; of the existence of which it had given notice. Means should, therefore, be provided for at once checking the escape of steam in this latter case.

Fusible metal applied to a flue is to act as a warning thermometer, to inform the engineer when, by any accident, the temperature of the flue is raised above the proper point. This taking place when the supply of water is already defective, any escape of steam is objectionable, since it still further diminishes that supply: it is more objectionable than in the case of the boiler, as the relative situations of the surface of the flue and boiler to the water, cause a more considerable extent of surface of the former than of the latter, to be laid bare by a given depression of the level of the water below the top of the flue.

Different methods have been suggested of applying fusible metal to the flues of boilers. It has been proposed to apply a fusible plate directly to the flue: to such a plan the strongest objection is that the contents of the boiler would be discharged, with more or less violence, through the opening made by the fusion of the plate, even if the water were below the level of that opening. If this should fail, in the case of a high pressure boiler, to produce the destruction of human life, it would, in all cases, expose to the delay necessary to a complete cooling of the boiler, and to the replacing of the plate; it might occur at a time when the desertion of the prime mover would be as dangerous as an explosion.

Arrangements which require the access to the boiler to be cut off by stuffing are, in general, bad, when the parts passing through the stuffing box are to serve as an alarm, and are to be moved only at distant intervals, exposing them to adhesion from change in the packing, or from oxidation. The proposal of an anonymous author to apply to the flue a mass of fusible metal, in which the lower end of a rod should be fixed, the upper end passing through a stuffing box on the boiler, is liable to this objection. Besides this, however, there are others, foremost among which stands the effect of galvanic action, which, according to the metals used, would oxidise the flue itself, the rod, the fastenings of the fusible metal, or one or more of the components* of the alloy.

The tubes terminated by fusible metal, proposed by Mr. Ewbank,†

* The order in which iron and copper, the materials of boilers, rank with lead, tin, and bismuth, the components of fusible alloys, in the electrical series, is as follows: copper, bismuth, tin, lead, iron, the last named being electro-positive with regard to those which precede it. (Berzelius, traité de Chimie, tome iv. p. 571.

† Journal of Franklin Institute, vol. x. p. 1.

are, in my opinion, superior to either of the methods just examined: by extending them to the vicinity of the flue they might be so prepared as to melt when it should become unduly heated: the tubes being small, the escape of steam would not be important. The tubes would be exposed to the effects of galvanic action, and when the ends were once fused, could not, conveniently, be renewed while the boiler was in action.

The following apparatus combines the requisites of giving warning when the temperature of the flue reaches a determinate limit; of not producing, necessarily, the escape of steam; of being free in its action; and of being renewed with great ease, after having given warning.

A tube of iron or copper, closed at the lower end, passes through the top of the boiler, its closed end reaching the flue, to which it is attached. The material of the tube will depend upon that of the boiler. This tube, it will be observed, affords a ready access to the flue, to ascertain its temperature, without any restraint from packing. Such tubes were used by Dulong and Arago in their experiments on the elasticity of steam at different temperatures, (and, also, by the committee of the Franklin Institute on Explosions,) to ascertain the temperature of the steam and of the water within their boiler. For this purpose, they were partly filled with mercury, into which a common thermometer was plunged, and thus conveniently placed or removed while its bulb was not exposed to the pressure of the steam.

A mass of fusible metal placed at the bottom of the tube, described in the beginning of the last paragraph, will become fluid very nearly as soon as the flue takes the temperature of fusion of the alloy. I would, in passing, note a point in relation to fusible alloys which is of great consequence in these kind of applications, and which, from some experiments, I have reason to believe may be attained; namely, that the proportions of the component metals should be so adjusted that the alloy will change its state, from a solid to a liquid, without going through a series of slow gradations.

The alloy contained in the tube might have its fusing point at thirty degrees Fah. above the working temperature of the steam. This, for a low pressure engine, working at two atmospheres, would allow a range of more than one atmosphere above the working pressure, before it fused; putting out of the question the fusion of the metal by ordinary variations in the temperature of the water surrounding the flue. In a high pressure engine working at eleven atmospheres interior pressure, the fusing point of the alloy being placed at thirty degrees above the working temperature would not exceed 397 degrees Fah. Larger limits might be taken without incurring danger, should practice show that these are inconveniently small. The object not being to give notice when the steam is saturated and highly elastic, and the water, therefore, the same temperature as the steam, the fusing points of the alloys should be considerably above those of the plates attached to the boiler, and above the temperature corresponding to the pressure for which the safety valve is loaded. The case to be met by the apparatus is that in which the flue itself becomes unduly heated.

To show when the metal at the bottom of the tube becomes fluid, a stem is attached with a cord and weight, or, as shown in the annexed cut,* with a lever and weight. The weight and longer arm of the lever, in descending, may be made to ring a bell, or, by appropriate attachments, to turn a cock, permitting just enough steam to issue to give the alarm, and then to be closed at once. A projection on the lower end of the rod prevents it from being drawn from the metal until this latter is fused, and by widening the lower part of the tube, making it slightly tapering, the metal is kept from being drawn out by the rod.

When the alloy has fused, indicating an undue heating of the flue and its cause a defective supply of water, it is only necessary at the time of giving the required supply to remove the weight and return the rod to its position in the fusible metal, which, as it congeals, will enclose it: by replacing the weight the apparatus is again prepared to do its duty. The solidifying of the metal will show when the temperature of the flue has been duly reduced. Should this be ascertained by sounding with the rod itself, it might be drawn out just when the metal was in the act of congealing, and thus its return to its place be prevented. This would destroy an important quality of the apparatus, and to avoid such a chance a wire should be provided with which to sound, for the purpose of ascertaining the state of the alloy. In the event of such a mischance, or of any circumstance which should solidify the metal before the rod could be returned, it is not difficult to see how the small quantity of alloy might be rendered entirely fluid: such a case, although it should be provided for when accident may produce it, should be avoided by the attention which would almost insure its non-occurrence. I have spoken of the melting of the alloy as indicating a deficiency of water in the boiler, since this would generally be the cause producing its fusion. Another cause should not be passed without mention, as it may lead to a peculiar location of the tube, namely, the effect of the sediment sometimes allowed to deposit upon the flues. This sediment interposes a stratum of imperfectly conducting matter between the metal of the flue and the water; the heat thus prevented from passing to the water, accumulates in the flue and leads to a dangerous state of things. These circumstances ordinary care may prevent, and in the intermission of that care notice of the approach of danger may be derived from the action of the alarm. Such a case is an extreme one, requiring nothing less than a cleansing of the boiler to remove risk; the checking of the fires, if not their extinction, should follow a warning given, when the water was ascertained to be at its proper level, or when the introduction of more water did not cause the alloy to recongeal. It cannot be expected of any device to provide a remedy for the negligence which would allow the accumulation I have supposed; a notice of its existence would be neglected at the peril of all concerned.

Unless a boiler be made of very undue thickness, never the case

* See page 223.

in practice, the metal itself can hardly oppose sufficiently the passage of heat from the parts in contact with the flame to those in contact with the water, to produce any dangerous accumulation of heat.

In determining the position of the tube reference should be had to the construction of the boiler. If the flue be inclined, the proper position for the tube, intended to meet the case of undue heating from a deficient supply of water, would be upon the higher part, as likely first to be laid bare. In reference to the deposit different modes of construction would require different locations, which might render necessary a separate apparatus from the former.

For the use of the engineer, a second tube may be provided, at the side of the first, to contain an alloy fusing at a low temperature,* or mercury when it could be used, into which a thermometer being plunged would show the temperature of the flue. A similar device, already alluded to, being conveniently placed, will give him the temperature of the steam within.† If a thermometer be deemed too fragile an instrument to be used in this place, an alloy less fusible than the one used in the proposed alarm, may be similarly applied, its indications being given to the engineer alone. Before referring to the cut for a detailed explanation of the apparatus which has been, in a general way, described, it may be well to pass in review some of the points which should meet with attention in its construction.

Of the first importance is to be considered the connexion of the tube with the flue so as to prevent the introduction of sediment between them. This may be accomplished, among other ways, by providing a projection at the bottom of the tube over which a ring being passed (as shown in the cut) and secured to the flue, will attach the tube closely to the latter. If the tube, thus connected with the flue, should pass by a screw joint through the top of the boiler, any change in the position of the flue would tend to separate the attachments of the tube or the parts of the tube itself. To provide against this the tube should pass through a stuffing box on the top of the boiler; this would allow it to move, the fastening to the flue remaining firm. This box, it should be observed, is in nowise connected in its action with the parts of the alarm. The movement of the tube will render necessary a small allowance in the position of the lever with respect to the bell.

The tube should be made as small in diameter as is consistent with the free action of the rod. The water is excluded from the space on the flue occupied by it, and if this space were considerable the temperature of that part of the flue would be higher than that of the rest. The tube must be so small that the metal may not fuse when the flue is covered with water.

If a bell be used in connexion with the stem and lever, the weight attached to the longer arm of the lever should enable it to raise the

* Two parts, by weight, of bismuth, and one of tin, give an alloy which fuses at 200 degrees Fah. The fracture of the thermometer by the congelation of the alloy, in an open tube, need not be feared.

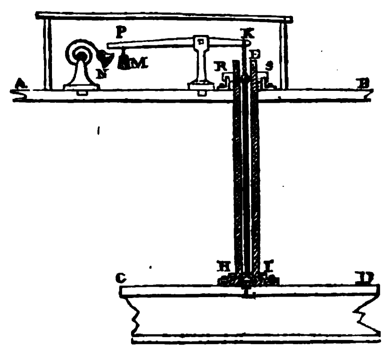
† The use of the thermometer has been most judiciously insisted upon by Professor Renwick in his work on the steam engine.

rod, and to overcome, with certainty, the resistance of the spring to which the bell is fastened.

A cover should be used to prevent the access of rain to the tube, and the whole apparatus should be inclosed in a grating that it may not be tampered with; the captain of the boat should have the key of this grating.

If this apparatus were applied to the connected boilers of our western boats, the frequency of the action of the alarm, when the flues become bare by the careening of the boat, might lead to a neglect of its indications. The apparatus would then merely give notice of what ought to be known without it, namely, that the higher boiler, or boilers, have a defective supply of water and are becoming unduly heated.* That these circumstances are not always accompanied with danger no one contends, and that some plan must be adopted by which the evil spoken of may be remedied is as clearly admitted. As long as human life is thus trifled with by permitting the known and frequent recurrence of danger, alarms of any kind must be useless. The defects incident to these boilers† must be remedied before this or any other alarm can be usefully applied to them.

Annexed to the cut, which follows, are references giving a more detailed description of the apparatus.



A B is a section through the top of a boiler; C D, a corresponding section of its flue. E H represents a tube closed at the lower end, which is attached to the upper side of the flue. The mode of attachment by a projection on the tube and a ring screwed to the flue, is shown in the cut; as also the stuffing box, R S, through which the upper end of the tube passes. The lower part, H I, of the tube, is made tapering, to retain the fusible metal. K L is the stem, the lower part being inclosed by the fusible metal, the upper part attached by a chain to a lever K P. The weight M draws the rod K L upwards, and on the fusion of the alloy H I, carries the lever below the bell N, which, being attached to a spring, rings an alarm. The apparatus is inclosed in a grating; that part of the top which is above the tube should be so made as to prevent the admission of rain to the tube.

* For this, and other judicious remarks, I am indebted to the kindness of a friend, to whom a description of the apparatus was submitted before publication.

† For proposed remedies, see the papers of Messrs. Williams and Evans, before referred to.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Practical Observations on the good and bad properties of the Colours used by Artists. *By* Joshua Shaw.*

(Continued from p. 10, vol. ix.)

In pursuing my observations on colours, I shall next notice that denominated Antwerp blue, which consists principally of cobalt, apparently in a semi-vitrified state, combined sometimes with alumina and sometimes with Prussian blue, generally with the latter, which forms about eight, or from that to fifteen per cent. of the article of commerce. It is extensively used by the manufacturers of paper hangings, and has within a few years, got into some favour with the artists. It is not so opaque as Prussian blue; and on the whole is a preferable colour; it is very manageable and pleasant to use; when reduced with white it exhibits an inclination to green, more or less; the very best to be met with has this failing. Portrait painters make a free use of it in their draperies, and frequently depend upon it for the gray tints of the flesh, combining it with Indian red, brown ochre, calcined vermilion or lakes. It should never be used except for draperies, the green foliage of trees, or such objects as have no standard by which its liability to change can be detected. In flesh tint, where the carnation merges into gray, there are very few colours indeed which can be relied upon, however carefully attended to, and that do not, in the course of two or three years, verge into a green, destroying the entire effect, and giving the subject a sickly appearance.

The only unchangeable blues are, first, the ultramarine, or ultramarine ashes, the latter, however, is for the most part liable to objections which I shall notice under its proper head. In my preceding observations, I have mentioned indigo as a valuable substitute for Prussian blue, and I shall here introduce it again as a substitute for ultramarine ashes. I have made many experiments with it, and all of them go to prove it a most valuable colour. Once being short of both ultramarine and the ashes, I charred some fine Spanish indigo in a crucible, which I afterwards ground in oil, and ventured to use it, at risk, and found, after several years, that it fully answered my expectations. When combined with white, it as much resembled the ultramarine ashes as could be well imagined, and it suffered no visible change after many years; I tried it in every possible way to put it to the test, and it still continued the same; it was not affected by the sun, and to this day I have recourse to it whenever I am short of the only superior article, ultramarine, or good ashes. If, therefore, economy is to be the order of the day with artists, it may, in the absence of the other, be relied on as a safe colour for the gray

* The first essay under this title will be found at p. 10 of the last volume; an accident which happened to the writer has retarded the appearance of the second, and his absence from this country will occasion some delay in their continuance; it is his design, however, to complete the series as early as circumstances will allow.

and pearly tones which are so frequent, and which form such an exquisite variety in the fairest complexions of the softer sex.

I once had occasion to copy a fine landscape by David Terniers, and it was the only colour by which I could truly imitate his chaste and silvery tints; reduced with white it matched most exactly the silvery blue sky, and broken with fine calcined Roman ochre it made the dark cloud tints, the distances, &c. &c.

But to return, Antwerp blue, like Prussian, may be occasionally used in broad draperies broken with white, after the manner previously recommended in the use of the latter, and rendered very permanent by a thin transparent coat of ultramarine glazed over it. It is nevertheless but an indifferent article to rely upon as a universal attendant on the palate, and should be confined to foliage, broad draperies, &c. &c.

The next blue, in respect to rank, is Cobalt blue, as it is called, but which assumes a great variety of forms, and is not always in commerce the true or genuine article. Fine blue pigments have of late years been much speculated upon, and chemists have made many discoveries, some of which are very valuable, having produced colours contending for rank with ultramarine ashes; others again are but sorry imitations of cobalt, and by which the young and inexperienced artist is frequently duped both of his money and reputation. I shall, however, in my next, endeavour to put him in possession of such facts as will assist him in the choice of this article, and the best mode of applying it in practice.

If, in my explanations, I have apparently digressed a little from one subject to another, I have done so for the sake of comparison, and with a view to assist the artist, who will, perhaps, understand me better than he would were I to attempt a perfectly methodical arrangement, or trite classification of the materials described. I am very sensible that men of science may consider my essays as too desultory, but if I am understood by those for whom I write, I shall at least render them a service, and in so doing shall have accomplished every thing which I proposed when I undertook my present task.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

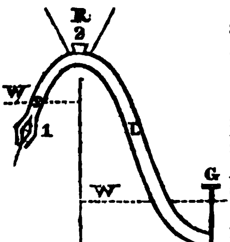
Proposed Improvements in the construction of the Syphon.

The following remarks relative to some proposed improvements in the construction of the syphon, is submitted to the consideration of the committee on publications by DANIEL LIVERMORE.

The operation of the syphon when made on a large scale is liable to obstruction by an accumulation of air within, which prevents the continuity of the water near its summit. This defect may in a great measure be obviated by the following arrangement. Place a valve near the lower end of the shortest leg, to open upwards, and another smaller valve on the top of the syphon, likewise opening upwards, and enclosed within a funnel shaped reservoir, the passage from

which to within the syphon is closed by shutting the valve, or when open the water may be admitted from said reservoir, and retained within until the syphon is filled; the outlet being closed by a gate or sliding valve fitted to the end of the longer leg, which remains shut until every thing is ready for operation.

The manner of operation will be more readily explained by reference to the annexed sketch.



Let the dotted lines W, W, represent the surface, below which S and L receive and discharge the water.

The stop gate G being closed, and the valve 2 open, the syphon is filled by pouring water in at R. When full the valve 2 is placed on its seat, and covered by the water left in R, to prevent the admission of air. G being raised, the water ascends through S, and descends L to the outlet. If any considerable diminution is observed in the discharge, we may conclude it is occasioned by an accumulation of air within the syphon.

By closing G the valve 1 will likewise be closed, but before this can be effected, if the stoppage at G be sudden, a concussion is produced by the continued action of the water, which forces itself with any air which may be within, through the valve 2, leaving the syphon free to act with renewed energy. The valve 1, if made in the form of a double cone (as here represented,) and properly proportioned, gives, when opened to the extent permitted by its tail piece, an undiminished water way, without *increasing the internal area* of this section of the syphon. This I believe is considered desirable by philosophers, but in many cases a contraction of the water way is not so important but that a plain valve of ordinary construction might be substituted. For most practical purposes the syphon is made on a small scale, and the outlet may more conveniently be closed by a stop cock than with a sliding valve.

The entrance and discharge of the water might be considerably facilitated by adjutages of proper construction; and for a syphon on a large scale, may probably be applied with considerable advantage.

FRANKLIN INSTITUTE.

Explosions of Steam Boilers.

(No. XXIX.)

New York, July 30, 1832.

TO THE COMMITTEE ON EXPLOSIONS.

Gentlemen,—Presuming that some account of the recent disaster on board the steam-boat Ohio, would be acceptable to you, the following is respectfully submitted. As I believe this explosion was the natural consequence of a defective construction or arrangement

of the internal flues, and as the same plan is adopted in nearly all our new boats, and in a majority of all others belonging to this city, it is of immense importance that the true character of this "*plan*" be ascertained and made known.

Very respectfully,
THOS. EWBANK.

Explosion of one of the boilers of the Steam-boat Ohio.

An explosion occurred in one of the boilers of this boat on Friday evening, July 6, when near Sing Sing, on her passage hence to Albany, by which five more of our citizens have perished. This is the fifth disaster of the kind reported in the course of the present year, and every one of which, it is believed, accompanied with loss of life.

I precede my remarks upon this explosion by a letter from the captain of the boat to the editors of the daily papers, and by the testimony given before the coroner's jury.

"*Steam-boat Ohio, July* 7, 1832.

"GENTLEMEN,—On our passage up yesterday afternoon, an accident occurred on board of the boat under my command which is much to be deplored. A short distance from Sing Sing, while under a common head of steam, and plenty of water in the boilers, a rent occurred in the steam chimney of the starboard boiler. The steam and water rushed out of the boiler, and, melancholy to relate, scalded three of the passengers. Every attention was shown to the sufferers, who died before morning. Their names were John Conner, of Albany, William Farnham, of Greenbush, and Eli Bower, of Poughkeepsie; also two of the crew, Samuel M'Mullen and Rob. Steward, are missing, who, it is presumed, jumped overboard.—These are the only persons missing, as far as I can learn. There were upwards of three hundred persons on board, part of which went to Newburgh in the Experiment, and the remainder returned with the boat to New York. As there was no other boat out last evening there was no occasion for an extra head of steam. The injury to the steam chimney can be repaired in a short time, and she can take her place, and leave here on Monday afternoon for Albany at 5 o'clock.

MARTIN BARTHOLOMEW, Master."

"Captain Bartholomew, commander of the boat, testified that he left this city last evening, for Albany; when about thirty-six miles from this city, he heard an explosion which he immediately ascertained had been caused by the bursting of the steam chimney; this was about fifteen minutes after 8 o'clock, last evening; in consequence of the bursting of the chimney, the water was forced back through the return flues and out the door of the furnace.

The names of the deceased persons now on board, are John Connor, of Albany, aged 30 years; Wm. Farnum, of Greenbush, aged about 26 years, and Eli Brower, cloth manufacturer, of Poughkeepsie, aged 40 years. The first two named were lieing on the skylight

which covers the cabin, exactly opposite to that part of the furnace through which the water rushed. Mr. Brower was standing near the same place. The boat was under a moderate press of steam, about fourteen inches; the boat often carries eighteen inches, and sometimes twenty, with perfect safety; they sometimes proceed with less steam than fourteen inches, when no more can be had; there was a sufficiency of water in the boiler, as one of the men who examined can testify; the chimney was iron, and was placed there new last season; the chimney is always expected to last as long as the boiler, which is about five years: the boiler was overhauled a short time since.

Two other persons besides those now on board dead, are lost; they were hands on board; their names were Samuel M'Mullen and Robert Stewart; they leaped overboard and were drowned before efficient aid could be rendered to them.

Peter Mathews, a fireman on board, testified that there was fifteen inches of steam on—he had just tried the quantity a minute before the accident occurred; the boat frequently carries seventeen inches, a quantity which is perfectly safe; does not recollect to have seen her carry twenty inches; has been in her about two years; the chimney was considered in good order.

Nathaniel Cornell, a hand on board, examined the water about five minutes before the accident occurred; there was then enough in the boiler; however, added some more, so that the accident could not have been caused by any insufficiency of water in the boiler; witness examined the chimney about two weeks since, it was then in good order.

Marcill Manning examined the chimney about a week since, it was then in good order; a patch was placed on one side of it about seven days before; it was not at the part repaired that the chimney burst, but much lower down, and on an opposite side.

Alexander Homestrum, the engineer, corroborated the testimony of the other witnesses as to the state of the steam and the water.

In addition to this testimony, the jury examined the bodies on board, and also the state of the chimney and boiler, and returned a verdict that the deceased persons had been scalded to death in consequence of the accidental bursting of the steam chimney on board the Ohio."

It is to be regretted that when disasters of this kind occur, inquiry is seldom instituted with a determination to ascertain the cause *any further than as it may implicate the captain, or the engineer and his attendants.* When no blame can be attached to them, the explosion seems to be looked upon as a mystery too dark to be scrutinized, and little or no effort is made to explore it. The rupture is repaired, and the boat runs again as before. Public excitement is transient, and the occurrence is soon forgotten except by the relatives and friends of the sufferers.

So long as this continues to be the case, there is no security that hundreds more of our citizens will not be hurried out of existence by steam-boat explosions. These awful occurrences cannot be

prevented except by removing the causes of them. And how can they be removed, while these remain unknown?

That the primary cause of the present explosion was not known to the captain, may be inferred from the latter part of his letter, where he says "the steam chimney can be *repaired*, and the boat take her place on Monday;" and that it remains equally unknown to the owners and others concerned, would appear from their merely repairing the ruptured flue, (which they are doing,) without altering in the least its internal arrangement.

By referring to page 131, vol. ii. of the Journal of the Institute, the committee will find the origin of "steam chimnies;" but as no description sufficiently definite is there given of one, I have enclosed a sketch of that of the Ohio.*

Fig. 1

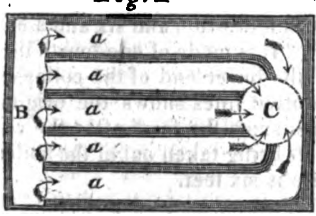


Fig. 1, is a plan of the flues and bottom of the boiler. A is the front end, at which the fuel is applied. The flame passes under the bottom to the other end, where it is received into the box or case B, which is open at its under side. The horizontal flues *a, a, a, a, a,* are connected with the case B; and their other ends lead into C, the main flue, which passes vertically through the boiler, (see fig. 2.) The dark parts in fig. 1 are spaces left between the sides of the boiler and the flues, and between each of the flues, and are occupied by water. The arrows show the direction of the flame.

Fig. 2

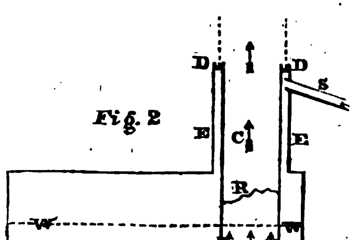


Fig. 2, is a longitudinal section of the boiler. C, is the ruptured flue, its upper part enclosed in another tube E, E, called a "*steam chimney*," attached to the top of the boiler, and forming part of it. A space is left all round C of 6½ inches. E, E, and C, are united at D, D, and made steam tight.

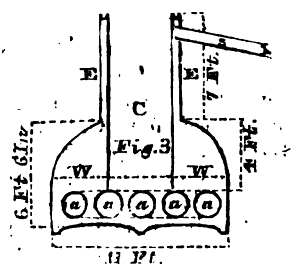
The chimney proper is merely slipped on C at D, D, and held to its place by braces. At the upper

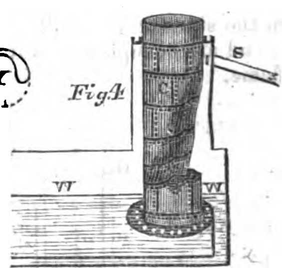
* In the course of conversation with an intelligent engineer who assisted me in obtaining information in relation to this explosion, he remarked that the rapid corrosion of the interior of iron boilers, might, in many cases, be attributed to the copper in the composition of the air pump, valves, feed pump, and pipes, &c. the water passing through them into the boiler having a *galvanic influence on the iron of the boiler*. In one case he observed that the part of an internal flue immediately opposite the mouth of a feeding pipe, and about four inches from it, was entirely eaten away, leaving a hole in the flue nine inches in diameter.

end of E is inserted the steam pipe S, it projects three inches, (or about half way,) through E, as represented. It is eleven inches in diameter. The horizontal flues, five in number, are twenty inches in diameter.. The vertical flue forty-two inches. From its junction with the horizontal flues, (only one of which is seen in this figure,) to its upper end at D, D, is eleven feet. The water line at W, W, is about ten inches above the horizontal flues, and the remainder of C, being ten feet of its length, is always uncovered by water. The rent took place at R, from fifteen to twenty inches above the water line.

The line of fracture does not deviate more than six inches from a horizontal direction. It is partly along a row of rivets, but chiefly through the centre of the sheets. In one sheet the fracture exhibits the metal from one-fourth of an inch (its original thickness,) to one-eighth, and less than one-sixteenth.

The boiler is eighteen feet long, eleven feet wide, and six and a half feet deep, (see fig. 3,) its ends are flat. It is made of one-fourth inch wrought iron. Y, shows the form of the lower end of the collapsed flue; the circular part contained in dotted lines shows the original form of the flue, the irregular full lines show the form after the collapse. Fig. 4 represents it previous to its being taken out of the boiler; from the rent to the top of the collapse is six feet.





It will be perceived that the rent took place in that part of the main *flue* unprotected by water, and not in the steam chimney proper. This part of the flue is *always* exposed to the flame or heated air, and *never* covered by water.

Engineers consider it necessary to keep internal flues as well as those portions of the sides of boilers which are exposed to the fire, covered by water, as the only means of preventing them from rending; but in using steam chimneys, a method the *very reverse* is adopted. By them part of the flue above the water, is *necessarily* exposed, and this part embraces nearly *the whole* of the main internal flue, in which is accumulated all the heat and flame from the furnace that escapes through the horizontal flues.

In the Ohio, the part thus exposed is ten feet long and three and a

half feet diameter, the whole of which is always uncovered by water, except what may be occasionally thrown up against it by ebullition.

The circumstance of this flue being in a perpendicular position can impart no additional security from the action of the fire, but rather the contrary, since the whole of its circumference is exposed to its influence. The only difference in its favour is that the greatest portion of heat from the furnace is probably taken up by the bottom of the boiler and the horizontal flues before entering it; and this is the supposition of those who advocate the use of steam chimnies. The heat, they further say, is "*exhausted*" before entering the vertical flue, and that without regard to the nature of the fuel used.

But if the heat were *exhausted* before entering the vertical flue, the steam chimney would be useless, as its design is to impart the extra heat of the fire chimney to the steam.

This heat is, however, far from being exhausted. The working cylinders of the Ohio are nearly forty feet distant from the steam chimnies, consequently the steam pipes are about the same length; and yet the packing of the pistons, and the hempen covering of the steam pipes, have frequently been charred.

The temperature of that portion of the horizontal flues near to where they unite with the vertical one, will be much the same as the lower part of the latter. If there be any difference, the vertical flue is probably the hottest, because the heat from all the others is there received by it, and the direction of the draft is suddenly changed at the same place: hence, if part of the horizontal flues are in danger of collapse when uncovered by water, the lower part, at least, of the vertical flue is equally so, and from the same cause.

But the appearance of the ruptured flue is a sufficient proof that the heat is not exhausted before entering it. It is fairly burnt out. In some places not even one-sixth of its thickness is left. The greater part of this flue was new about eighteen months ago, but the part rent has been in use a little more than two years.

When it is considered that the part rent was constantly liable to be made *red hot*, and probably was frequently so, we need not wonder that it collapsed under a pressure of fifteen pounds to the square inch. The greater wonder is, that it withstood it so long.

The same cause also accounts for the rapid destruction of its material. Indeed these flues are all rapidly worn out at the same place, and this is the testimony of an experienced manufacturer of steam engines. It is corroborated also by that of an intelligent engineer, who informed me lately that one of our largest and most splendid boats, had a new vertical flue last season, and yet a portion of it had to be replaced near the water line a few weeks ago, being no longer safe.

There is another circumstance attending the use of steam chimnies which still further promotes the destruction of the flue in question, viz. the large quantity of mud and other matters that float on the water is drawn against this flue (where it hardens and forms a crust)

by the current of the steam in rushing up into the steam pipe at every stroke of the piston.

Fusible plates and valves have been designed to prevent the temperature of the steam from exceeding that of the water on which it reposes, but these devices are totally inapplicable to steam chimnies, since the very evil they are designed to prevent, is considered an advantage in the use of the latter.

The advantage of steam chimnies, it is said, is that "they rarify and still further expand the steam after it is generated;" but its expansive *force* cannot thereby be increased above that in the other parts of the boiler; for steam of different elastic power cannot exist in the same vessel at the same time. And whether they are of any advantage by depriving the steam of a portion of its moisture, previous to its entering the cylinder is at least doubtful, since it is one of its constituent principles, by depriving it of which, its density is proportionably diminished, and upon the density and temperature depend the expansive force of the steam.

The theoretical question of the effect of heating steam, after it is produced, in contact with the water which produced it, requires further elucidation. And after this should be determined we must consider the effect to be derived from transmitting this rarified steam through the pipes to the cylinder. But let us admit for steam chimnies all the advantages which have been claimed for them. Let us admit that their use economises heat which would otherwise be lost or less perfectly applied, and then let us answer the question, can these advantages make up for the increased dangers of explosions? can a paltry consideration of doubtful economy justify the exposure of human life incident to the use of a *heated flue uncovered by water?* The answer is plain, and the public are interested in making it heard.

THOS. EWBANK.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN APRIL, 1832.

With Remarks and Exemplifications, by the Editor.

1. For a machine for *Planing Boards, Cutting Tenons,* reducing marble, and other hard substances, and for grinding and polishing the same; Moses Lancaster, Northern Liberties, Philadelphia county, April 5.

(See specification.)

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2. For a machine for *Hulling Clover, Buckwheat and Bar-*

ley, and for scouring wheat; Thomas Register, West Township, Columbiana county, Ohio, April 5.

The specification informs us that in this machine there is a cylinder of free, or sand, stone, two feet in length, with an iron spindle through it turned by a crank; a concave of the same material, which is borne up against the cylinder, and a hopper for the grain or seed.

Not a word occurs respecting novelty, invention, or claim; we infer, therefore, from this, and from other circumstances, that there was no room to assert either.

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3. For a machine for *Cleaning Clover Seed*; George Faber, Chambersburg, Franklin county, Pennsylvania, April 5.

(See specification.)

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4. For an *Apple Grinding Machine*; Jonathan R. Dean, Augusta, Columbiana county, Ohio, April 5.

This is a very simple machine. A block of wood, formed like a grindstone, is to turn on an axis in the same manner; brads, or wires, are driven into it, standing out one-eighth of an inch, and a concave piece is to encompass one-third of this grinder, its lower edge standing close to the spikes; this concave is to be surmounted by a hopper, and there is to be a trough below to catch the pomace.

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5. For an improvement in *Doors, by which the common threshold is superseded*; Eastman R. Ball, Oswego, Oswego county, New York, April 5.

The lower rail of the door is grooved to receive a strip, or valve, which when the door is shut is protruded downwards, and when it is open passes up into the groove.

The strip is held, and acted upon, by an angled lever, which stands in a mortice within the rail, above the groove and strip. A rod which is let into the rail, from the back edge of the door, is forced out by a spiral spring, and this raises the strip when the door is opened. When it is shut, this rod comes in contact with the rebate of the door frame, which, forcing it in, acts upon the lever and depresses the strip.

Contrivances very similar to this have been before made and patented.

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6. For *Preparing Yarn and making it into Packing suitable to use about Steam Engines*; William V. Grinnels, Middletown, Middlesex county, Connecticut, April 5.

Yarn made of hemp is to be boiled in strong brine, and after allowing it to cool it is to be soaked for several days in ley, made of ashes and lime; after this it is to be dried, plaited, and worked up for use.

What good properties are communicated to the yarn by this process we are not informed; perhaps, however, it is intended to render

it as incombustible as Salamander's wool, that it may resist these high degrees of heat which destroy the packing in engines of extremely high pressure.

7. For *Stocks for Gentlemen's wear;* Edmund Badger, city of Philadelphia, April 5.

(See specification.)

8. For an improvement in the *Machine used for Pegging Shoes and Boots;* Frederick Gray, Rowley, Essex county, Massachusetts, April 6.

The machine here patented for pegging boots, consists of an improved apparatus for holding the last firmly during the operation; to explain this contrivance clearly, would require a drawing, and we think but few will feel interest enough in the subject to regret the want of this appendage.

9. For *Seasoning Timber by means of Steam;* Abraham Plumb, Buffalo, Erie county, New York, April 6.

We are at a loss to imagine in what place the patentee can have lived that he should have arrived at manhood without hearing that the seasoning of timber by means of steam is a process well known and frequently practised. When we saw the title of the patent we concluded that some new apparatus, or mode of application, formed its basis; but we are simply told that the timber is to be put into a tight box, and to have steam from a boiler admitted to it through a pipe; and the claim is merely to "the application of steam to green lumber for the purpose of facilitating and hastening the seasoning, drying, and fitting it for use."

10. For a *Washing Machine;* David G. Wilson, Machias, Washington county, Maine, April 6.

A trough with a semicircular bottom, has a shaft crossing it, and carrying within it what the patentee calls moveable divers, that is, vibrating frames, formed of slats, which, being moved by a handle, squeeze the clothes to be washed against the grooved ends of the trough. This being nothing more than a trifling variation from preceding machines, we do not think it necessary even to insert the claim of the patentee.

11. For a *Spiral Flanched Shell, to be used as a substitute for the ordinary Bomb Shell, or Howitz;* William B. Pier and Andrew Mask, Detroit, Wayne county, Michigan Territory, April 6.

(See description among the specifications.)

12. For a *Machine for making Axes;* Josiah Pratt, jr., Claremont, Franklin county, Massachusetts, April 6.

This machinery consists of what the patentee denominates hammer and anvil dies; the first kind are to be worked like a trip hammer, the last, as the name indicates, forming the anvil, or bed. A particular description of the curvature of the faces of these dies, and of their size, is given in the specification.

The foundation of the axe from the bar of iron, is laid with one pair of dies, and another set is used for finishing. There is no claim made; reliance being placed on the entire novelty of the whole plan. "The manner of holding the iron under the dies, and the skill of moulding the axe," we are told, can be learnt only by observation and practice."

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13. For an improvement in the *Striking part of Clocks;* George Parker, Utica, Oneida county, New York, April 7.

Without a more lengthened description than, in our opinion, the alleged improvement calls for, we cannot make known the particulars in which the arrangement of the striking part, as described by the patentee, differs from that of the common clock; the object, we presume, is to construct it with somewhat less labour than that usually required, but the mode of accomplishing this is not clearly made known by the description and drawing.

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14. For an improvement in *Coaches, Barouches, and all kinds of Carriages;* Robert Gedney, city of New York, April 7.

The improvement described and claimed, consists in forming a moveable top, or cover, by which a barouche, or other open carriage, may, when desired, be converted into a close one.

The top may be made of wood, metal, leather, or any other suitable substance, and consists of two parts, each of which is a quadrant of a cylinder, working upon joints, or pins, in the centres of their curvature, on the side of the carriage. The body of the carriage must be made double, to form a cavity into which the covers which form the close top may fall; these cavities and tops are made much in the way with those of some circular fall writing desks. There are circular segments, or ratchets, to hold the tops in any required position; and in the ends, or peripheries, of the moveable tops, windows or blinds may be placed. The claim is to the "method of forming a moveable cover to barouches, and carriages of all kinds, by means of moveable segment covers turning on pivots, and shutting, or folding, within each other, so as to form an open, partly closed, or wholly closed, carriage."

If there is no objection to the perfectly circular, or cylindrical form which must be given to the body of the carriage, we do not know of any other that can be urged against this plan; we, however, are apprehensive that this form will not suit the large hats of the ladies, or admit of the desired perpendicular attitude in gentlemen above the middle stature.

15. For an improvement in the *Gun Lock;* Francis Dowler, Wayne, Knox county, Ohio, April 9.

The difference between this and the ordinary percussion lock consists in attaching to the usual lock plate nothing but the hammer lever by which the powder is to be exploded. The lever which acts upon the tail of the hammer, the main spring which bears against it, and all the other apparatus of the lock, are attached to the trigger plate, and are modified in their form accordingly. There is no claim made, nor do we perceive the slightest advantage to be derived from this particular construction.

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16. For machinery for *Jointing Staves* by means of a circular saw, and for *Sawing Bulging Staves* by means of a concave-convex circular saw; Philip Cornell, Brutus, Cayuga county, New York, April 11.

(See description among the specifications.)

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17. For a *Washing Machine;* Simeon Savage, East Machias, Washington county, Maine, April 11.

The washing in this machine is to be effected by passing the clothes between two wooden rollers, placed side by side across a trough, one of them being allowed to recede from the other whilst it is borne up against it by means of a weighted lever. In the operation of washing, a crank, attached to the gudgeon of one of the rollers, is turned with one hand, whilst with the other the clothes to be washed are conducted between the rollers; a sufficient quantity of soap suds being always kept in the trough.

The claim is to "the general arrangement of the machine herein described; that is, a machine with two horizontal rollers, one of which is borne against the other in the manner set forth."

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18. For machinery for *Cutting and Manufacturing Wooden Boxes;* Harrison Holland, Belchertown, Hampshire county, Massachusetts, April 13.

Wooden boxes are of so many kinds that the above title must fail in furnishing any definite idea of the intention of the machinery, nor does the petition, or the specification, supply the required information; we collect, however, from the drawing and the general description of the apparatus, that the boxes are to be round, and made out of solid stuff. An auger, running in the mandril of a lathe, is used to bore the boxes out, whilst cutters, placed at a proper distance from the auger, form the outside. A sliding carriage in front holds the timber, and this is brought up by proper contrivances against the auger and cutters. A circular saw, upon a sliding carriage, is used to cut the box off. The lids, it is said, may be formed on the same principle, but in this case the auger is to be shortened in due proportion. At the end of the specification we are told that "green timber will answer as well as that which is seasoned. This information is not calculated to throw much light upon the purposes for

which the said boxes are to be made, as they will soon lose their rotundity if made of unseasoned stuff.

There is no claim made to the machinery as a whole, or in part, excepting that in speaking of the auger with which the boring is to be effected, it is said that it is "a screw auger, *without a centre;* this is claimed as a new invention, and may be applied to other uses." The fact is, that the screw auger, without a centre, has been applied to other uses long since, and therefore it is not new. We have in our possession one of this description, which was patented so long since that the patent has run out.

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19. For an improved *Steam Valve,* called the "Face Plate Valve;" Stacy Costil, Philadelphia county, Pennsylvania, April 13.

The specification before us describes no particular construction of valve, but would apply perfectly well to a large proportion of those in general use. The patentee gives us no further information than that the valve consists of two plates with cavities, that it is made of iron or other metal, fitted so as to prevent the escape of fluids, except through the cavities, when they come opposite to each other; that there may be one or more cavities for the passage of the fluids; that the valve by a rotary motion may be used as a pump; (?) that the plates may be held together by a screw, or otherwise; that when the plates are in such a position that the cavities are not opposite to each other, the fluids are confined; and that the valve can be applied to cocks, &c.

The foregoing contains the whole sum and substance of the specification, and those who know any thing upon the subject will perceive that it would embrace in its generalizations, the various kinds of sliding valve, the old rotary valve of Oliver Evans, and a great number of others. What the patentee intended to patent, and thinks he has patented, we cannot divine.

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20. For a *Washing Machine;* Silvanus Minton, Anderson District, South Carolina, April 14.

This washing machine resembles the old fashioned cider mill, in the construction of the rollers which are to effect the washing. Two fluted rollers, each ten inches in diameter, are placed one over the other, with a suitable trough beneath them. The flutes, or teeth, mashing in like those of a cog wheel. The upper roller is borne down by weights, allowing it to recede from the lower one.

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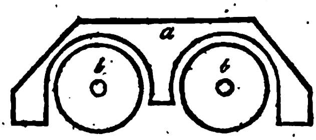
21. For *Apparatus to reduce the Friction in Axletrees;* Francis Reese, Habersham county, Georgia, April 14.

This apparatus to reduce friction consists of two rollers placed one behind the other on the lower side of each axle; they are to be

three inches long, and one and a half inches in diameter, are to be let into mortices, and to revolve upon suitable gudgeons, their peripheries bearing within the boxes. The same thing, exactly, has been done before, and there is, therefore, no novelty in the contrivance; but a still less fortunate circumstance than this, is its entire want of utility. The gudgeons of the rollers are not adapted to bear the heavy weight which they have to sustain, and soon wear out. The rollers must bear against iron or steel within the hubs, or they immediately make a groove; the jolts to which they are subjected soon convert the rollers into polygons, and they cease to turn; besides all this, and much more, the weight cannot be made to rest on the rollers, were they calculated to sustain it, as the draft of the wagon will always cause the side of the axle to bear against the hub.

22. For a *Ruler for Counting Houses, &c.;* James Carrington, Wallingford, New Haven county, Connecticut, April 14.

This is intended as a substitute for the common round ruler, to which it is certainly much superior. It consists of a piece of mahogany, or other wood, made in the form shown at *a*, which is a transverse section of it. There are two grooves along the under side of it, to receive the two parallel rollers *o, b*, which extend its whole length, and revolve on pins running in metal plates at each end of the ruler.



The tendency of this ruler is always to run parallel; it does not readily slip like the common ruler; the bearing of the pen or plummet, is near to the paper, whilst the rollers keep the ruler sufficiently elevated to prevent all danger of blotting.

23. For a *Churn*, called the revolving Dasher Churn; Hardin Branch, city of New York, April 18.

Within a box, the bottom of which is made concave, there are revolving dashers, turned by a crank upon one of the gudgeons which passes through the end of the box.

The claim is to the before described churn.

We are of opinion that any one who will either make, or purchase such a churn from the patentee, or from any other person, may, with equal propriety, lay claim to the before described churn, without the necessity of placing the fact upon record in the patent office.

24. For a *Thrashing Machine;* Hardin Branch, city of New York, April 18.

The beaters of this thrashing machine are hinged to the cylinder, as has been repeatedly done. There is a hopper, or inclined plane, feeding rollers, a concave of bars, whirls, bands, &c., all of which are noticed in the description; after which a claim is made to "the

before described machine." The concluding remark relating to the last noticed patent, will apply equally well in the present case.

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25. For *Fastenings for Bedsteads;* Hardin Branch, city of New York, April 18.

A piece of cast iron, or other metal, is affixed to the end of the rail, and a corresponding piece on the post; the latter is in the form of a dovetailed wedge, and the former has a cavity within which it fits. The rail fastens on to the post by letting it drop down so that the cavities pass on to the wedge. One of the earliest of the various contrivances for dispensing with screws in fastening bedsteads, was of this character. In the present instance, however, the mode of attaching the fastenings to the rails and post is more simple, and proportionately less secure; this is the only *improvement* which we can discover in the thing. The claim is to "the before described method of fastening the posts and rails of bedsteads together by the dovetailed mortise and wedge, or tongue."

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26. For a *Machine for Thrashing and Grinding Grain;* Matthew Wilson, Springfield, Rockbridge county, Virginia, April 18.

This is said to be an improvement in Samuel Cochran's wheat thrashing machine; but judging by the improvement alone, we apprehend that there are many other persons who may lay claim to the original. The claim to improvement is, in the first place, the gearing the horse power, by which the thrashing machine is to be driven so as to give it a quicker motion than ordinary. Secondly, the manner of applying a band from a drum around a pulley; this consists in giving the band two turns and crossing it, which the patentee says is "altogether new." The cast heads of the cylinder upon which the planking and beaters are fixed, and the secure method of putting them on are also claimed. By the same horse power which performs the thrashing, a small grist mill is to be driven; and the mode of gearing and manner of working this, form another claim.

If the claim to gearing so as to give greater speed than ordinary, is one which can be sustained, every additional cog added to a driving wheel, and every leaf subtracted from a pinion, may be the subject of a patent. We should demur to the novelty of crossing a band, and passing it twice round a whirl, and indeed to most of the points upon which the patentee has rested his right as an original inventor.

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27. For *Door Fasteners;* Calvin Washburn, Bridgewater, Plymouth county, Massachusetts, April 18.

This is a spring door catch, operated on by handles in the usual way, but with some peculiarity in the arrangement of the parts which may be called new, and upon which the claim rests. We are not aware, however, that it is superior to some others, and shall there-

fore dismiss it, as, without a drawing, its peculiarity could not be easily described.

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28. For an improvement in the *Mode of drawing Soda and other Mineral Waters;* George H. Duffey, Alexandria, Alexandria county, Virginia, April 19.

We have given an account of five different patents, each having the same object in view with the present; that is, to draw off by one cock the liquor from two separate vessels, one of which contains an acid solution, and the other a solution of carbonate of soda. The patentee in the present case says that this invention "consists in making the divisions and openings in the tube of the key so that liquids may be conveyed down each division separately, and not unite till they meet in the glass or vessel for receiving them, whereas the method lately patented, and now in use for drawing soda water by means of a compound cock, is to suffer the two liquors to unite in the cock, whereby the stronger liquor is forced up the tube of the weaker, and the whole spoiled."

We are not certain, and do not think it necessary to ascertain, whether in all the five patents previously obtained, the mixture of the liquids takes place before it actually leaves the cock, or not, although we believe this to be the case, but we do not believe that the evil above stated, namely, that the stronger liquor is forced up the tube, &c., necessarily, or generally, exists—by the by, which is the stronger and which the weaker liquor of the two named, we really do not know—where, from the height of the fluids, there is a moderate pressure, this pressure combined with the ready exit which *they* find from the cock, would prevent such an effect. Some of the former patentees claim the drawing off of two fluids by one cock, and either this claim is worthless, or the present interferes with it.

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29. For a *Churn,* called the "balance lever churn;" Caleb Argevine, city of New York, April 19.

This churn is two churns, each of which has its dasher and staff. A lever is made to vibrate like a scale beam, and has a dasher staff attached to each of its ends, the churns being firmly fixed on a platform beneath them. A band wheel, turned by a winch, gives motion to a whirl, on the shaft of which there is a crank, and a pitman from this crank causes the lever to vibrate. What the patentee "particularly" claims "is the equalizing power and combined advantages of the driving wheel, fly wheel, crank, and horizontal pitman, in giving motion to two churns in one operation."

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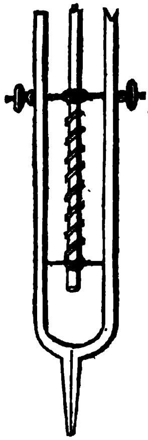
30. For a *Centre Point Spring Bit;* Daniel Flint, Nobleborough, Lincoln county, Maine, April 19.

This bit may be likened, in form, to a tuning fork, the handle of which would represent the shank, and the forked ends the cutting



points. One of these points is notched, so as to cut a double groove, and the opposite point is chisel shaped, to cut out the stuff between the two grooves. The bit may be fixed in a lathe, or stock. To gauge it to the exact size required, a thumb screw passes through the two forks, and by means of this the points may be drawn together. The inside edges of the cutting ends may be so formed as to give a taper, or beviled entering to the plug which is to be cut out by it. There is also a centre piece, which being borne up by a spiral spring, recedes as the points advance.

The principal intention of the bit is to manufacture plugs for ships, although it is applicable to other purposes, such as making bungs for barrels, &c.

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31. For a *Cutting Box for Straw, Stalks, &c.;* Jacob Harland, Tompkinsville, Monroe county, Kentucky, April 19.

A winch, which is to be turned by hand, has on its shaft a fly wheel and crank. The crank gives motion to the cutting knife, which is fixed in a frame, working up and down at the front end of the box, like a saw frame. The feeding is effected by a rack, and the parts, generally, operate upon the same principle with a number of other straw cutters. There are certain claims made, but they refer to trivial points, and not to any thing essential to such a machine.

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32. For apparatus or machinery for *Holding and Guiding Edge Tools in the operation of Grinding;* George A. Madeira, Chambersburg, Franklin county, Pennsylvania, April 19.

(See specification.)

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33. For *Protecting Bank Notes, &c.* from being counterfeited; Francis Peabody, and Joseph Dixon, Salem, Essex county, Massachusetts, April 20.

The object had in view by the patentees is to prevent the counterfeiting of bank notes by means of lithography. Those acquainted with that art are aware that the impression upon a bank note, or other engraving, printed with ink into which oil enters as a component part, may be transferred on to stone, and the stone then used to furnish similar impressions on paper. According to recent accounts from Europe the utmost perfection has been attained in this process, which, as it is merely mechanical, may enable one who is no artist

to imitate the work of the best engravers in a way which shall defy detection.

The means by which the patentees effect their object is by taking printers' ink, or ink made from oil, which is to be of a pink, light blue, or other tint, and which will serve as a ground for the black ink generally used in printing bank notes. The paper intended to be printed on is first covered wholly, or in part, with the light coloured oleagenous ink, and after this the notes are printed with black ink in the usual way. Any attempt to make a lithographic transfer from paper so prepared must fail altogether, as every part which has either the tinted or the black ink on it, will affect the stone, and only a confused, blurred impression, can be obtained from it.

The claim is to the preparing of paper in the manner described.

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34. For a *Washing Machine;* Benton P. Coston, city of Philadelphia, April 27.

The soap suds and the clothes to be washed are put into a suitable trough, and within this trough is a fluted washboard; a fluted roller, borne down by springs, is made to vibrate over the board by proper contrivances, of which we have as little inclination to give a description, as most of our subscribers would have to read it if given.

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35. For an *Engine for Turning Whip Sticks,* or Handles; Andrew Mallory, Russel, Hampden county, Massachusetts, April 27.

This engine is intended to be used in turning whip handles tapering, either regularly or otherwise, and it may also be employed for helves, or other sticks, whether cylindrical or tapering. The stick to be turned may be fixed in the mandril of a common turning lathe, and the apparatus here patented placed in front of it. It consists, in part, of a frame with parallel sides, equal in length to the length of the stick to be turned. A piece carrying a cutter, which operates as a gouge and chisel, slides along in grooves on these sides. This sliding part consists of two bars hinged together at one end, and capable of being opened or closed at the other; and near to this latter end is fixed the cutter before spoken of. The stick to be turned rests on a hollow bearing of metal on the lower piece, and the cutter passes through the upper piece. It is evident that if these two parts, which form the hinged sliding bar, recede from each other as the bar advances, the article operated upon by the cutter will have a corresponding increase in its diameter. To effect this, each of the bars has a tongue on it which slides in a groove on one of the cheeks of the frame. There are, of course, two grooves, and if these were parallel to each other, the two parts of the sliding bar would keep at the same distance apart, and the article turned would be cylindrical; but if the grooves recede, the bars will be gradually separated, and the article will be tapered.

The whole machine is claimed as new, and not as an improvement on any other for the same purpose previously known.

36. For an improvement in the *Plough;* John B. Norton, Utica, Oneida county, New York, April 27.

This is to be a self-sharpening plough, and the description amounts, altogether, to but five lines. The improvement is said to consist in a recess on the back of the mould board, and a projection on the flanch to fill this recess, which is to be sufficiently wide to prevent the flanch from tipping, or changing its position on the mould board; it is intended, likewise, to prevent the flanch from shifting when the pattern is being moulded. The foregoing description is somewhat obscure; we have the drawing before us, but there is in this also so much taken for granted, that we have not sufficient imagination to fill up the chasms, and may in consequence, suffer great loss.

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37. For *Obtaining Opium from the Poppy,* by expression; Lucius Cook, Shrewsbury, Monmouth county, New Jersey, April 27.

We have here a specification still more brief than the last, being merely informed in it that opium is to be expressed from the poppy by a press of any kind; a screw press, like that of an oil mill, being preferred.

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38. For *Applying Copal or other Varnish* to Whip stocks, or other articles, by dipping; Frederick Morgan, Westfield, Hampden county, Massachusetts, April 27.

The articles to be operated on are to be dipped into a tube filled with the varnish, which, it is said, is a superior method to the use of a brush. This is the whole recipe, and we are very apprehensive that there are but few persons in the habit of using varnish who have not occasionally resorted to the same mode; we have repeatedly done it, although not with whip stocks, and we may probably do it again, with "other articles," the patent before us to the contrary notwithstanding.

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39. For a *Floating Screw Dock;* Stephen F. Stinchfield, New Orleans, Louisiana, April 27.

The floats which in this contrivance are to answer the purpose of wharves in the ordinary screw dock, are formed by two boats, or flats, securely framed and planked. Screws, with their proper nuts, are sustained upon these floats, and are of sufficient length to reach down to the cradle beams over which the vessel is to be floated, and upon which there are the necessary keel blocks, bilge blocks, and other appurtenances. The claim is to "the before described floating screw dock, for raising vessels, or for floating them over sand bars, or when run aground."

The screw dock has been previously patented, and is extensively used; and as it is intended to employ this floating dock for the purpose of repairing vessels, we apprehend that the claim of the patentee will not be available, for although he uses floats instead of

wharves upon which to sustain his screws, these still operate in the same way with those alluded to.

We are at a loss to perceive how, on the plan we are now considering, the cradle beams are to be passed under a vessel which is aground; there may possibly be instances in which this can be done, but we think they must be very rare.

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40. For a machine to *Prepare Card Boards* to receive the handle and the card; Homer Whittemore, Newtown, Queen's county, New York, April 27.

The card board is to have two dovetailing kerfs sawed into it by means of a circular saw, in the usual manner. It is then placed upon a machine which holds it firmly, and a chisel, fixed in a sliding frame, is brought up by a crank, and cuts out the chip, which there is also a contrivance to remove. The handle is then driven in to its place, and the projecting part of it planed off by revolving planes, attached to the mandril of a turning lathe.

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41. For a *Lever Power Machine for Propelling Mills*, and which may be applied to boats, water craft, rail-road carriages, &c.; William Rhodes, Trenton, Gibson county, Tennessee, April 27.

This is another of those miserable schemes for gaining power which can deceive those only who are totally ignorant of the principles of mechanics, a class, however, which, unfortunately, appears in every community to be a very large one.

A crank placed on the end of a vertical shaft is to be turned by horse, or other power; at the lower end of this shaft is a large horizontal crown wheel, the teeth of which drive a wallower; and from the shaft of the wallower rises a pitman, which alternately elevates and depresses two long levers of the second kind. Palls, or catches, descend from these levers, and engage into ratchet wheels on a horizontal shaft, there being two such wheels, one for the catch of each lever. The levers, as they rise, drag round the shaft of the ratchet wheels, and from this, the power, *created* by the described arrangement, is to be communicated and employed for any required purpose.

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42. For a *Rotary Toggle Joint Press;* Thomas W. Harvey, Jamestown, Chautauqua county, New York, April 27.

Without a drawing we shall not attempt a description of this press, particularly as we expect, at an early day, to publish the specification, with an engraving. We will merely observe that what is usually called the toggle joint is not employed in it, the two levers which operate upon this principle not being connected together, although they are brought into contact with each other by the revolution of two parallel shafts from which they project. The machine is about being put into operation in New York, and should it answer the anticipated purpose, it may be applied to the cutting of various

articles; to stamping impressions from dies, and for a great variety of other objects.

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43. For a machine for *Planing, Tonguing, and Grooving Boards;* John Drummond, Whitestown, Oneida county, New York, April 27.

Two pulleys, of about eighteen inches in diameter, and which run vertically, are placed at such distance from each other as shall correspond with the length of the stuff to be planed. Planes are attached to a strap, or band, which passes round these pulleys, and the plane stocks are supported by ways, on which pins, or a tongue, projecting from it, bear, as the straps and planes revolve. The board to be planed is placed upon a horizontal bed, or bench, so situated that the faces of the planes shall pass over it. The planes, as they pass round, strike against a spring catch intended to shift the board under them, laterally, at every stroke.

The claim is to "the before described machine for planing boards; particularly the way, with semicircular ends, the belt and pulleys by which the plane, or planes, are moved and governed; and the moveable parts for giving proper thickness to the boards."

We are of opinion that this machine has never been tried in practice, as we believe that after doing so the inventor would have declined taking a patent for it; the objections to it appear to us to be numerous and insuperable.

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44. For a *Wind and Water Wheel;* Adkins Nash, Addison, Washington county, Maine, April 27.

This is a wheel with wings, or buckets, hinged, or suspended by pins, upon which they turn, in order to their being presented edgewise, or flatwise, to the fluid which is to act upon them.

The floats, or wings, are to be made concave on one side and convex on the other; the wheel, when used for wind, is to be placed vertically, and a very complex apparatus of ropes and blocks is employed to give to the wings, or sails, a proper direction; four pulleys being used to each wing. There is an endless screw and a cog wheel employed to turn a barrel, over which pass numerous ropes that are reeved through the pulley blocks in a way which we do not think it worth while to describe. When operated upon by water the floats are to regulate themselves.

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45. For a *Process for Flattening Window Glass;* John J. Adams, city of Washington, District of Columbia, April 27.

The apparatus here patented is intended for flattening cylinder window glass. It consists of a circular oven, or flattening furnace, having in it a circular rail-way of cast iron, upon which the flattening apparatus can be made to revolve. The cylinder is to be put in through the stick hole, and, as it is acted upon by the fuel, is carried round until it arrives opposite to one of the flattening mouths, where it is flattened out upon a stone in the usual manner. By further

turning, it is carried round until it arrives at what is called the cooling arch. This is an arch of about thirty feet in length, and three in width; within it two endless chains pass over rollers which cross it at suitable distances, for sustaining the chains. Upon these chains are keyed plates of sheet iron, about three by two and a half feet, upon one of which the flattened plate is laid from the flattening apparatus; the endless chain is then carried forward by turning a winch until another sheet of iron presents itself to receive another plate of glass; the plates are thus gradually carried along the cooling arch, until they are ready to be delivered from the far end.

The plan of the cooling arch is similar to that of the annealing ovens at the flint glass works, and would undoubtedly answer the intended purpose; we have not equal confidence in the annealing furnace, and the apparatus within it. Without the aid of actual experiment it is not possible to say that the fire can be so managed as to afford the exact degree of heat which is requisite, or that the revolving rail-way would not be attended by unanticipated difficulties in the course of its operation.

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46. For an improvement in the *Grist Mill;* Amos Barnes, Colesville, Broom county, New York, April 27.

It is said that by this improvement the power required for driving the mill is lessened, the motion of the stone regulated, the friction reduced, and even grinding promoted. The stones are to be about two feet in diameter, and the upper one, the runner, is to be covered with a casing of cast iron, in order to give it weight; the eye of the stone is to be wider on the lower than on the upper side, and above the drum, or pulley, there is to be a balance wheel by which the mill is to be driven; there are to be several other contrivances which, however, are so similar to what we have had repeated occasions to describe, that we omit further notice of them. A number of things are claimed, some of which, as that of weighting the stone, the form of the eye, &c. &c. are old; if, however, the mill performs better than any other, as the patentee says it does, that at least will be something new.

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47. For a *Reaction Water Wheel for Mills;* John Moffit, Richmond, Ross county, Ohio, April 27.

This is very much like the common tub wheel, but there are some provisions made respecting its structure which we do not fully understand.

The wheel, we are told, is to be made of eight solid blocks, and is to run horizontally upon the lower end of a shaft, which is to be a hollow cylinder in order to prevent the too great weight of water upon the wheel. This cylinder is to be surrounded by another, and between these the water is to descend to the openings which surround, and are near to, the periphery of the wheel. There are to be eight of these perforations passing obliquely from the upper to the lower surface, at an angle of forty-five degrees. The improvements principally relied on, are the delivery of the water at the bottom in-

stead of the side of the wheel, and the double cylinder for its descent.

We perceive no advantage, whilst there is a real disadvantage in delivering the water at the bottom, instead of at the sides; the point of delivery of a large portion of the water must be considerably nearer to the centre of motion on the former, than on the latter plan; and besides this, the delivery at the bottom is not itself new.

48. For a *Machine for Spinning Wool and Cotton;* David Newbrough, Riley Township, Butler county, Ohio, April 27.

A spinning wheel, instead of turning one only, gives motion to six, or more, spindles, by suitable bands. The carded rolls are placed in troughs or gutters opposite to the spindles, and there are the requisite contrivances for winding the yarn upon the spindles after it has been spun. There, however, is nothing worth a particular description, as the whole apparatus is similar to a number of other domestic spinners patented a few years since, but which have gone out of fashion since the extensive introduction of machinery into our manufactories.

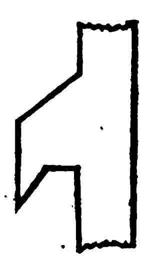
49. For a machine for *Hulling Clover Seed;* George Monohon, Augusta, Columbiana county, Ohio, April 27.

A trough is made which is to be eight feet long, two feet wide, and one foot high. The bottom of this trough is concave lengthwise, to a radius of twenty feet, and is fluted across in flutes of half an inch wide. Within this, is fitted a convex rubber which may be about half the length of the trough, and is furnished with handles, for the purpose of working it backward and forward.

After describing this contrivance, the patentee adds that he also claims the right to any machine made of wood in the form of mill stones, whether placed horizontally or perpendicularly, enclosed within a hoop, or otherwise, guttered, or reeded, and whether moved by horse, or man, power. The description of the actual machine did not certainly prepare us for such a claim to machinery which bears scarcely any analogy with it; and which indeed seems to us to be a little like claiming all rubbing machines, past, present, and to come.

50. For an improvement in the *Saw Mill;* John R. Drake, Owego, Tioga county, New York, April 27.

The saw frame and fender-posts of this machine, are constructed in the usual way, the main difference in it being in the form of the teeth of the saw. In a saw of six, or six and a half feet in length, there are to be about twenty teeth, the cutting points of which are to project downwards like a "duck's bill chisel." The form intended will be seen by the sketch in the margin. Guide pieces are to be fastened



to the fender posts, through notches in which the saw is to work, and it is thus to receive a lateral support; the claim is to the peculiar form of the teeth, and to the guides.

The latter have been frequently used, and the former, we apprehend, will not often be adopted. For most kinds of timber, the cutting such teeth, will be too rank; but, independently of this, a saw so formed will last but little time, as, in the process of sharpening, the teeth will not merely retire back, but will actually disappear. Teeth made in the usual manner can be so sharpened as to cut upon the proposed "duck's bill" principle, by merely filing them hooking underneath, and taking off the point nearly straight, on the front edge of the saw.

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51. For an improvement in the *Turning Lathe;* William Green, Bedford county, Tennessee, April 27.

The inventor says that this lathe has a carriage moved by iron cogs, to work the gouges, and an oblique and nipped bit for smoothing and centring cylinders; the gouges, &c. being tempered by screws.

Whatever merit may be attributed to this lathe in the part of the country where the patentee resides, he would, in other parts of the Union, find it to be a very rude kind of instrument. He may have invented the whole as described by him, but, were he well acquainted with the lathes now in use, he would acknowledge his own to be a very indifferent make-shift.

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52. For apparatus for *Preventing Chimneys from Smoking;* Jeremiah Sullivan, Washington city, District of Columbia, April 27.

Jambs, a top plate and back, are to be made much in the usual form of the Franklin stoves; the upper section of the back plate is hinged, so that it may be opened, or closed, at pleasure, to alter the size of the throat. In addition to this, there are to be sliding dampers to draw out and regulate the draft in the flue. In these consist the alleged *invention*, although such contrivances are well known and extensively used. We have had repeated occasions for making similar remarks, the latest will be found at p. 163, where it will be seen that a similar apparatus was patented on the 17th of March last.

There is not any thing said in the form of a claim, and, of course, the whole arrangement described is viewed by the patentee as new.

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53. For a *Cotton Press;* David Philips, Natchez, Mississippi, April 27.

There is some novelty in the construction of this press, more, in fact, than is exhibited by a majority of those patented for the same purpose. The packing is effected by means of a screw which is placed vertically, operating upon followers in a box placed horizon-

tally, and the machine may be so constructed as to pack two bales at once.

Two strong beams, thirty-four feet in length, and two feet in width, are to be laid horizontally; these are connected together by end pieces framed into them, which end pieces are equal in length to that of the bale to be formed. This frame, when enclosed below and above with proper doors, forms the boxes into which the cotton is to be forced by the followers. From the middle of this frame rise two vertical cheeks between which the screw is sustained; this screw may be twelve or fourteen feet in length, and extends down below the horizontal box where the power is applied to turn it. The nut through which it passes slides between the cheeks, and is raised and lowered by turning the screw, which does not itself ascend or descend, but merely moves the nut. Now we will suppose the nut raised between the cheeks to the upper part of the screw, and the followers to be withdrawn from the horizontal boxes in which the cotton is to be packed; in this state of things the doors are to be opened, the boxes filled with cotton, and the doors then closed, when the operation of pressing commences. In order to cause the nut, as it is drawn down, to act upon the follower, strong pieces of timber are hinged to it by one end, and by the other to the followers; and when the nut is up, these timbers may stand at an angle of forty-five degrees with the frame; as they are drawn down they approach towards a horizontal position, and when completely down are actually horizontal. The two acting together operate like the toggle joint which is straightened by the screw, thus forcing in the followers upon the cotton.

The usual provision is, of course, made in the boxes to receive the bagging and ropes for baling the cotton, which needs no explanation as it is common to cotton presses of every description.

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54. For *Making Barrels, and other vessels, so tight as to hold Oil* of various descriptions; Barnabas Springer, Henry county, Indiana, April 27.

After the barrel, or other vessel, has been put together, the hoops are to be loosened, and the joints allowed to open, when glue is to be passed into all the joints, and the hoops tightened. The joints in the heads are to be previously secured in the same way. Would not gum water, or other mucilage, answer equally well, and be more easily managed?

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55. For a machine for *Moulding and Pressing Bricks;* Daniel Bomford, Deerfield, Oneida county, New York, April 28.

Of this machine there is a long description given, which ends by claiming "the before described machine for moulding and pressing bricks;" the said machine, however, is very obscurely described as relates to some of its important working parts; and although we doubt not that, in point of arrangement, it presents sufficient novelty, there

is but little of it in its individual parts, or in the mode of its operation.

The clay, after being properly prepared, is put into a hopper, under which there is a carriage running horizontally, it being moved by means of a rack and pinion; the moulds are to be placed upon this carriage, and run under the hoppers; a presser, or follower, within the hopper, is then brought down, which carries a portion of the clay before it into the moulds; after this the moulds are run out, and the operation repeated.

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56. For *Preparing Luminous Glasses to be used in Orreries, Planetariums, &c.;* Morris J. Gardner, York, York county, Pennsylvania, April 30.

Globular, or other glasses, which are to represent planets or satellites, are to have a sufficient portion of phosphoric oil poured into them to moisten their inner surfaces. A small opening is to be left for a supply of air to excite the luminous appearance; this constitutes the whole invention, which is one of those that will, probably, not be carried into operation by any one except the inventor himself; at all events we are fully convinced that he will not make a fortune by his discovery. We could suggest what we deem much better modes of accomplishing the end proposed, but are apprehensive that even they would rarely, if ever, be essayed, and we are no admirers of abortions.

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57. For a mode of *Bleaching Yellow Wax;* John N. Shultze, chemist, city of New York, April 30.

(See description.)

Specifications of American Patents.

Specification of a patent for machinery for Planing Boards, Dressing Marble, and other substances, and for Sawing Tenons. Granted to Moses Lancaster, *city of Philadelphia, April* 5, 1832.

To all whom it may concern, be it known, that I, Moses Lancaster, of the Northern Liberties, in the county of Philadelphia, have invented an improved machine, which may be used for planing boards, and reducing marble, and other kinds of stone, metallic, and other substances, to a flat surface; and in which circular saws are also employed for the slitting of tenons, and other purposes, and that the following is a full and exact description thereof.

For the planing of boards I construct a wheel which is made to revolve vertically upon a horizontal shaft by any suitable power. Or instead of a wheel, two, four, or any other number of arms may project from said shaft, and carry such irons, cutters, grinders, and polishers, as are intended to be fixed upon the wheel. The diameter of the wheel must be more than double the width of the article to be

cut, planed, ground or polished. Cutters, made in the manner of plane irons, are employed for planing, their cutting edges being on one face of the wheel, and they being set and secured in their places by wedges, or otherwise.

I do not, in general, make the face of the wheel where the cutters operate, of a continued flat surface, but near to its periphery I turn it down, or otherwise reduce it so that it shall form two, three, or more parallel planes, each one-fourth of an inch, more or less, below the other. Each of these faces may be furnished with cutters; that nearest the rim taking the place of the ordinary jack plane, and the others in succession further reducing and smoothing the substance.

When stone, or other hard material, is to be cut, the cutters must be so formed as to adapt them to the intended purpose. When substances are to be ground, or polished, pieces of grinding or of polishing stone, or other suitable materials, occupy the place of the cutters upon the face of the wheel.

A carriage, or sliding frame, is made to run in grooves, near to the face of the wheel, and to pass above its axle, the frame work of the machinery being so constructed as to sustain and guide said carriage horizontally; it must be of such length and width as to receive the board, or other article to be operated upon by the wheel. Against this, such article is to be placed, its edge resting on proper ledges or supports, and the whole being held against the carriage by clamps, screws, or other contrivances.

The wheel is made adjustible on its gudgeons, so that it may adapt itself to the thickness of the article to be cut or ground.

For cutting tenons, I fix two or more circular saws upon the same shaft, regulating their distance from each other by disks of wood or of metal placed between them. The shaft carrying these saws is placed horizontally in the same frame with, and parallel to, that carrying the cutter wheel. The rails, or other stuff upon which tenons are to be sawed, are to be secured upon the sliding carriage before mentioned, with the end to be cut downwards, so that when the carriage is forced forward the revolving saws shall cut into it the proper depth for the tenon.

The saw shaft may be shifted endwise, like that of the cutter wheel, to adapt it to its purpose.

What I claim as my invention is the vertical wheel, constructed in the manner described, with cutters upon successive faces, retiring from each other, or with grinders or polishers applied in the manner and for the purposes hereinbefore set forth, and also the employment of circular saws for cutting tenons, operating in the way described in the foregoing specification.

MOSES LANCASTER.

Specification of a patent for a Machine for Cleaning Clover Seed. Granted to George Faber, *Chambersburg, Franklin county, Pennsylvania, April* 5, 1832.

To all whom it may concern, be it known, that I, George Faber, of Chambersburgh, in the state of Pennsylvania, have invented an improvement in the machine employed for the cleaning of clover seed, and that the following is a full and exact description thereof.

In my machine, the clover to be cleaned is made to pass between cylinders and concaves, as in many others constructed for a similar purpose; but my cylinders and concaves are set with teeth in a manner altogether different from that of such as have been heretofore made. I prepare wire cards by setting card teeth in leather in the usual manner, but of coarser wire, and with the rows between the teeth wider than ordinary. The wire, for example, may be about No. 17 or 18, and it is to be so set as to leave clear parallel spaces between the rows of teeth, which spaces may be an eighth of an inch or more in width. These cards are to be fixed upon the cylinders, with the teeth and spaces forming lines passing directly around, and parallel with their ends; and also in the hollow of the concaves in the same way.

When the cylinder and concave are fixed in the frame within which the former is to revolve, the teeth of the cylinder pass in the spaces between those on the concave; the two being placed so near to each other that the points of the revolving teeth come nearly in contact with the leather on the concave, and the teeth on the concave nearly touch the leather on the cylinder, whilst the teeth themselves run clear of each other, that is, those on the cylinder do not touch those on the concave.

The cylinder is made to revolve in such way that the teeth on it and those on the concave have no tendency to catch, their points being inclined in a direction opposite to that of the revolution.

I generally make the concave to embrace one half of the cylinder, or nearly so, but this is not a point of great importance. I commonly use two or more cylinders and concaves, placed below each other, so that the seed may be successively acted upon by the whole of them. The best arrangement I believe to be the employment of two cylinders with their concaves, such as I have described, and a third, not set with card teeth, but with its surface made rough, so that it may act as a rubber. This cylinder may be made of sheet iron punched from the inside in the way well known, or it may be formed of any other substance, or be covered with any article producing the same effect. Such cylinders having been frequently made, I do not claim them as making any part of my invention; I, however, have devised a new mode of constructing the concave in which such a cylinder may run; which concave, or apron, I form of leather, skin, cloth, or any similar material; this concave, or apron, I cause to pass around a portion of the cylinder, sustaining it by its ends upon suitable strips, or rods, to keep it in its place, without any other sup-

port. The part of such leather, or other material which reacts against the roller, may also be covered with any hard or gritty substance.

After the seed has passed the rollers covered with cards, and as it falls from them to the rubbing roller, I sometimes subject it to the action of the fan, operating with sufficient force to drive off a large portion of the chaff without blowing away the seed.

There are to be a feeding hopper, a crank for turning the machine, and the requisite whirls and bands, which do not require description.

What I claim as my invention is the manner in which the wire cards are made and fixed on the cylinders and concaves, as hereinbefore set forth. I do not claim the using of wire cards for the purpose of cleaning clover seed, they having been before so employed, but not operating upon the principle or in the manner in which they are used by me.

I also claim the application of the elastic apron, or concave, to a rubbing cylinder, in the manner, and for the purpose herein explained. The other parts of the machine which I have described, I do not claim.

GEORGE FABER.

Specification of a patent for Stocks for Gentlemen's wear. Granted to EDMUND BADGER, *city of Philadelphia, April* 5, 1832.

To all whom it may concern, be it known, that I, Edmund Badger, of the city of Philadelphia, have invented an improved mode of manufacturing stocks for gentlemen's wear, and that the following is a full and exact description of my said improvement.

I take hog's bristles, and weave them into a webbing, of linen, cotton, silk, or other suitable material; and from this webbing I cut my stocks into the proper form. I then bend them over a mould, or block, to give to them the intended form. Whilst on the block I stiffen them with shellac, or other varnish, after which they are finished by trimming in the usual manner.

What I claim as my invention, and for which I ask a patent, is the weaving of hog's bristles as a filling for webbing to form stocks for gentlemen's wear.

EDMUND BADGER.

Patent for an improvement in the Science of Gunnery, which may be used as a substitute for the ordinary Bomb Shell, or Howitzer; and which may also be substituted for the ordinary cannon shot or musket ball, and ejected from guns of any size or calibre. Granted to WILLIAM B. PIER *and* ANDREW MARK, *city of Detroit, Wayne county, Michigan Territory, April* 6, 1832.

The patentees denominate their invention an "elongated spiral flanched shell," and an "elongated spiral flanched shot." The

first is named from its peculiar form, and is to be cast of such size as shall adapt it to the ordinance from which it is to be projected. For the sake of ready description, a shell adapted to a three pounder is taken as an example. Its form, without the flanches, is that of an elongated egg, with the small end truncated, or cut square off. The length of the shell may vary from one and a half to two or more diameters of the bore of the piece from which it is to be fired. The reason of varying the length is to allow of a larger cavity in certain cases, where it may be required. When the cavity is large, and the shell consequently thin, it is elongated in order to give to it the necessary weight. The large, or forward end, which nearly fits the calibre of the piece, is a solid hemisphere of metal, the weight of which will insure its keeping the proper direction when fired from the piece.

Wings, or flanches, are cast upon the outside; of these there may be four, or more, they extend from the small end of the shell, to the swell of its hemispherical end; their direction is oblique, as they are designed to give to it a rotary motion like that of a rifle ball. Those edges of them which strike the air, are at right angles to the body of the shell, and they extend out therefrom, so that their exterior edges shall every where fit the bore. The angle which they make with a longitudinal section of the shell may vary from five to twenty degrees, more or less, as may be found best to answer the object intended. The diameter of the small or after end, may be reduced to one-third or one-half of that of the bulb or larger end, and the flanches, therefore, widen out in proportion. To charge the cavity of the shell, an opening is left either in the small end, or in the *side* between the flanches, through which the charge is to be introduced, and the opening then stopped with a screw, or a plug of wood or metal.

The shell is to be made to explode by means of percussion power. For this purpose a hole is to be drilled through the larger end, or bulb, of the shell, in the direction of its axis. This hole may be from one-fourth to three-eighths of an inch in diameter until it reaches near to the cavity, when it is to be continued of such size only as may serve for a touch hole. An iron or steel bolt, surrounded by leather, or other elastic substance, is put over the percussion powder, and extends out from the front of the shell; its exterior end widens out like a nail or bolt head. This striking against any hard substance, occasions the contents of the shell to explode.

The "elongated flanched shot" is similar in its external form to the shell, but as it is to be used as a shot merely, it has no cavity. When used for small arms it is to be cast of lead, to give it sufficient weight. The patentees say that its flight will be more rapid and its range greater than that of a round ball.

Patent for machinery for Jointing Staves with a circular saw; and for Sawing Bilging Staves, by means of concavo-convex circular saws. Granted to PHILIP CORNELL, *Brutus, Cayuga county, New York, April,* 1832.

For a full explanation of the particular construction of this machinery drawings would be required, a general idea of its construction may, however, be given without them.

The jointing apparatus is intended for such staves as are straight upon their edges. The staves are held down upon a carriage by means of a lever, the adjustable bed of the carriage having such an inclination as that rake shall give to the edges of the staves which shall correspond with the size of the vessel to be formed; in this state the carriage is made to advance, carrying the staves against the edge of a circular saw. Several staves, placed one upon the other, are jointed at the same time. There is nothing new in the principle of this part of the machinery, the patent, therefore, is taken for the particular arrangement by which the operation is effected.

For sawing barrel, or other bilging staves, a concavo-convex saw is made, which is a section of a sphere of such radius as shall adapt it to the bilge or curvature of the staves to be sawed by it. The staves are sawed one out of the other, either from plank or rived timber, of such thickness as the width of the stave may require. The carriage upon which the stuff to be sawed is fixed, has curved ribs, or guide pieces, taking into corresponding grooves in the bed upon which it runs, the radius of their curvature corresponding, of course, with that of the saw used.

The carriage is driven forward by means of an endless screw, a rack and pinion, or other suitable contrivance.

Sometimes an apparatus is used which joints the stave, giving the proper curvature and rake to the edges, at the same time that it is cut by the concavo-convex saw. This apparatus consists of two circular saws running on separate axes, and contained each in a sliding frame, governed by grooved guide pieces in such a way that as the stave advances against them they joint it in the manner described. We believe, however, that the machinery is rendered too complex by this addition, and that the patentee prefers to perform the operations separately. The patentee says:

"What I claim as new in the before described machinery, and for which I ask a patent, is the apparatus for jointing straight staves several at a time, one edge only, by means of a circular saw, and giving to them the proper bevel, as herein set forth. I also claim the sawing of bilging staves by means of a circular concavo-convex saw, whether the same be done by using a carriage upon the construction set forth in this specification, or by placing the saw itself upon a moving carriage. For although I have described and represented certain frame work, and modes of communicating motion, I lay no claim to this particular arrangement of the accessory parts of the machinery."

Specification of a patent for an apparatus for Holding and Guiding Edge Tools in the operation of Grinding. Granted to GEORGE A. MADEIRA, *Chambersburg, Franklin county, Pennsylvania, April* 19, 1832.

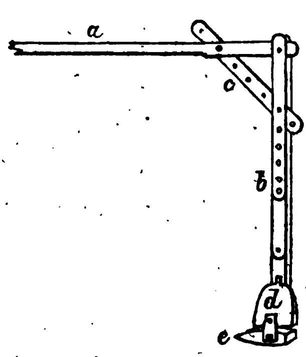
To all whom it may concern, be it known, that I, George A. Madeira, of Chambersburg, Franklin county, Pennsylvania, have invented an apparatus, or machinery, for holding and guiding edge tools, and other articles in the operation of grinding, which apparatus greatly facilitates the said operation, and will enable an inexperienced hand to perform it with precision; and that the following is a full and exact description of the said apparatus.

I use a spring pole, which is fixed along or near to the ceiling of the room or workshop, in the manner of those used for the pole lathe. The elastic end of this pole is directly over the grindstone, and from it descends a part which I denominate the hanger; the hanger is hinged or jointed to the spring pole, so that the angle which they make with each other may be varied. A brace passes diagonally from the spring pole to the hanger, a mortise being made through each for that purpose. This brace may be lengthened or shortened by means of pins, which pass through holes in it, and in the spring pole and hanger, and serve to confine them in any required position.

In order to adapt the hanger to articles of different sizes and kinds, it is made capable of being lengthened or shortened; this may be effected by dividing it and making one part to lap over the other, or by a long slot in one piece, and a corresponding tongue on the other, with equidistant holes through them, and pins or screws to adjust or confine them.

To admit of the article which is to be ground being moved backward and forward on the stone, there is a hinge, or rule joint, near the lower end of the hanger; and to allow of its transverse motion, the block upon the under side of which the article is to be held, is attached to the hanger by a hinge, or rule joint, in the reverse direction.

The block must vary in its form and construction according to the nature and form of the article to be ground; and the articles may be held in their places by means of screws, wedges, or otherwise. No particular directions can be given for this part, nor is it necessary, as every workman can readily adapt the block to the particular purpose which it is required to answer. The block is sometimes made with a handle projecting from each side of it, one for each hand. When axes, or other articles with eyes in them, are to be ground, the handle may pass through the eye, and form one part of the arrangement by which it is attached to the block.



I have thus described the manner in which I ordinarily form this apparatus; it, however, is susceptible of various modifications, whilst the general principle of its structure and action remains unchanged. I do not, therefore, claim the exact and particular formation thereof as herein set forth, but what I claim as my invention, and for which I ask a patent, is the use of a spring pole, with a descending part, which I have called the hanger, and a piece at the bottom thereof, similar to what I have denominated the block, to receive and hold the article to be ground; the apparatus being furnished with joints to admit of motion in two directions, and being adjustible in its length, to suit different articles.

GEORGE A. MADEIRA.

Patent for an improvement in the mode of Bleaching Yellow Bees-wax. Granted to JOHN N. SHULTZE, *Chemist, city of New York, April* 30, 1832.

Four vats are to be prepared which may each be about four feet long, three wide, and three deep; these are to be placed side by side, to facilitate their use. They may be numbered 1, 2, 3 and 4. Into No. 1, 200 lbs. oxymuriate [chloride] of lime, and 125 gallons of water are to be put; the mixture is to be well stirred, and the impurities allowed to settle. 500 lbs. of yellow wax are to be put into No. 2, and heat applied, either by steam or otherwise, sufficient to melt the wax, which is allowed to remain at rest, that its impurities may settle. The clear melted wax, and portions of the solution of oxymuriate of lime, are to be laded into vat No. 3, heat being applied to keep the wax melted, which, however, is not to exceed 160°. Nearly all the solution of oxymuriate will in general be used in this first process, which, however, will in general but partially bleach the wax. The mixture is to be constantly stirred for about an hour, in which time this first operation will be completed. A mixture, consisting of twenty pounds of sulphuric acid, diluted with thirty of water, is then added, and agitation kept up for half an hour. The acid, combining with the lime, sinks it to the bottom, and leaves the bleached wax floating above it; this settling is effected in about half an hour. The process has sometimes to be repeated a second or third time, depending upon the portion of colouring matter in the wax.

When the wax has been thus sufficiently bleached, it is put into vat No. 4, and as it still contains some water, this is to be separated from it. To effect this, thirty pounds of common salt are added, which being soluble in, unites with, the water, and the weight of this solution causes it to separate from, and descend below, the wax, which thus acquires a clear and transparent appearance.

To improve the white appearance of the wax, an ounce of pulverized Antwerp blue, previously mixed with a quart of the melted wax, is poured into vat No. 4, when the whole is deposited in proper vessels.

ENGLISH PATENTS.

Specification of the patent granted to GEORGE FORRESTER, *Civil Engineer, for certain improvements in Wheels for Carriages and Machinery, which improvements are applicable to other purposes. Dated September* 5, 1831.

To all to whom these presents shall come, &c. &c. —*Now know ye*, that in compliance with the said proviso, I, the said George Forrester, do hereby declare, that the nature of my said invention, and the manner in which the same is to be performed, are described and ascertained in and by the following description thereof, reference being had to the drawing hereunto annexed, (that is to say)—

My invention consists in a peculiar mode of combining cast iron with wrought or malleable iron in the construction of wheels of all descriptions, (excepting those of such small dimensions as the wheels of clocks and watches,) and in the application of the same principle of construction to the framing for steam engines and machinery, the arches of bridges, and in every case in which cast iron framing may be employed, and wherein great strength and lightness are desiderata.

My mode of accomplishing the aforesaid combination is as follows: I make a skeleton, or light frame, of wrought iron, or steel, of the shape of the article required, but of considerably less dimensions; this skeleton I render bright, free from oxide, and clean, by any convenient operation, such as grinding, scouring, and filing, to adapt it to receive a coating of lead, or bismuth, or tin, or zinc, or any mixture of those metals, such coating being performed by similar means to that used in the well known process called "tinning." The article to be cast having been moulded in sand (or loam) in the common way, the skeleton, coated as before mentioned, is carefully laid in the middle of the respective parts of the mould, projecting pieces being attached to the skeleton to keep it in its proper place; the mould is now to be closed, and the cavities formed by the pattern are to be filled up with fluid cast iron, which completes the operation.

By this mode of embodying or enveloping wrought iron or steel skeletons of the shape of the intended article, with cast iron, the latter material is not injured in its tenacity, while the former is considerably improved, and thus the important qualities of toughness and infrangibility are introduced into forms more perfect, and structures more solid than can be obtained in wrought iron alone. To prevent misconception, I annex a drawing illustrative of the construction of one of the leading objects of my invention, that of wheels for rail-way carriages, and which will also serve satisfactorily to explain the mode of applying the principle of construction to the purposes before named.

Description of the drawing.

Fig. 1 exhibits a side view of the wrought iron or skeleton framing before described.

Fig. 2 shows an edge or outside view of the peripheral ring of the skeleton, showing its proportional breadth, and containing a number of holes made throughout its circumference, for the purpose of allowing the fluid iron, in casting, to flow through the holes, and fix itself in a solid mass around the skeleton.

Fig. 1.

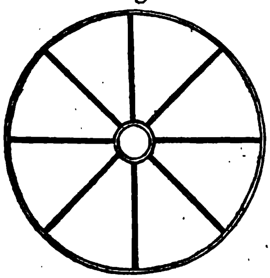


Fig. 5.

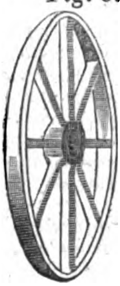


Fig. 3.

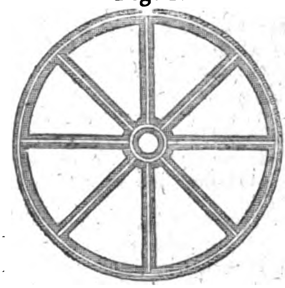


Fig 2

Fig 4.

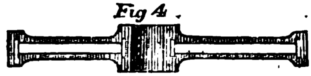


Fig. 3 represents a section of the wheel in the line of its motion, the blank line showing the skeleton embodied in the cast iron.

Fig. 4 shows a section of the wheel through its diameter, including two of the spokes; and fig. 5 affords a perspective view of the entire wheel. [*Rep. Pat. Inv.*

Analysis of the Report, &c. on Steam Carriages.

Report on Steam Carriages by a Committee of the House of Commons of Great Britain. With the minutes of Evidence, and Appendix. Reprinted by order of the House of Representatives of the United States. **(1832.)**

(Continued from p. 180.)

We apprehend that the minutes of the evidence before the committee will prove of more interest than the report itself.

The witnesses examined in relation to the progress, &c. of this branch of locomotion, were Messrs. Goldsworthy Gurney, Walter Hancock, Richard Trevithick, Nathaniel Ogle, Alexander Gordon, Joseph Gibbs, William Altoft Summers, and James Stone, who as inventors and patentees of different steam coaches, or as connected with them, must be considered in the light of interested witnesses; John Farey, Thomas Telford, Thomas M'Adam, and John Macneil, well known as civil engineers, Davies Gilbert, ex-president of the Royal Society and member of the committee on steam carriages, and Col. Torrens, a member of the same committee, having no other than a general interest in the progress of the invention.

From the testimony of Messrs M'Adam and Macneil, we shall derive useful information in relation to the turnpike roads of England,

and to the effects produced upon them by various agents. The remarks will be found less applicable than could be wished to roads in our own country, similar only in name to most of those spoken of.

We proceed with a condensed view of the more interesting parts of the evidence, quoting when the importance of the subject, or the method of handling it, requires such a course.

Mr. Gurney states that in his first attempts to propel coaches by steam, he used a propeller, or leg, projecting from behind the coach, that subsequently having found the adhesion of the two hind wheels sufficient, the propeller was only applied in ascending hills; that the adhesion proving sufficient in this case also, even with one wheel, the propeller was entirely laid aside. To prevent slipping, the steam is let very gradually upon the piston, ("wire-drawn.") He states several hills which his coach ascended, (Highgate hill, Stanmore hill, &c.) but does not give their elevations. These experiments were made in 1826.*

In 1827 further experiments were made which showed the practicability of using the steam coach to drag a second coach after it. A trip was made in one trial (load not stated) in which the carriage went 84 miles in ten hours, including stoppages. The weight of the steam carriage was, in this stage of its improvement, reduced from four tons, to thirty-five cwt. One of the coaches actually running between Gloucester and Cheltenham, is certified to weigh nearly three tons: this was not built by Mr. Gurney, though upon his plan. The hind wheels of Mr. Gurney's coach are five feet in diameter, the fore wheels one foot less. It is proposed to use smaller wheels when power, and not speed, is required. The tires of the wheels are three and a half inches wide, those of a common stage coach being about two inches. This carriage is upon springs, it is calculated (weight thirty-five tons,) to do the work of about three and a half horses.

Mr. Gurney calculates that three and a half bushels of coke and seventy gallons of water, are a charge for a stage of about seven miles when the roads are bad, requiring about half this quantity when they are good. The wear of the roads by this carriage is stated to be the same as that of ordinary carriages, estimating by the relative wear of the tires of the wheels of the two kinds of coaches.

The fuel used being coke, there is no smoke, and the escape steam is conducted into a peculiarly constructed chamber, so as to prevent noise. Horses sometimes start at the unusual appearance of the carriage; there should be in a well constructed engine no noise to alarm them.

From a clay rut of eight inches deep, the carriage was propelled by attaching a second wheel; up hills the friction of two wheels was frequently necessary. The stroke of the piston in the engine of this carriage is about eighteen inches. The pressure of steam used seventy pounds. The boiler tubes from half an inch to two inches in diameter, their thickness about the eighth of an inch, they are proved to about 800 lbs.

The carriage can be stopped within a few (six or seven) yards, by reversing the communication of the steam with the piston. Both carriages, when moving slowly, may be readily turned, the inner circle being about ten feet in diameter. The only accident which Mr. Gurney himself had met with in experimenting, was in the carriage moving too rapidly down hill (from carelessness in neglecting to lock the wheel,) and becoming unmanageable.

These carriages may be moved more economically upon paved roads, but on ordinary turnpikes they will answer. Not more than one-fourth of the power required upon a gravelled road is expended in moving over a pavement.

Mr. Gurney proposes that a toll should be exacted in proportion to the ratio of weight of a carriage, and to the average weight of a horse, which he fixes at ten cwt. He is of opinion that the hoofs of a horse would injure a road much more than the same weight upon wheels. At a rate below four miles an hour

* Those of Evans, it will be recollected, were made in 1804.—Reviewer.

a greater expense would be incurred by moving a burthen by steam than by horses; above four miles an hour, the economy is in favour of steam, the gain increasing with the speed.

Mr. Gurney has run at the rate of from eighteen to twenty miles an hour; there was no sort of difficulty in guiding the carriage when moving at the rate of twelve miles an hour.

From certain calculations, the details of which are submitted to the committee, Mr. Gurney concludes that steam-stage coaches may be run at about one-fifth the cost of the common coaches. The items are, first cost, wear and tear, and keeping. The details, if accurate in England, would be inapplicable here.

Mr. Gurney values a horse power at nine gallons (average) of water evaporated in one hour, under either high or low pressure. The rapidity of motion of a carriage, by enabling it more readily to overcome obstacles, is favourable to economy, so that a piston moving at the rate of fifty feet per minute will require more fuel to do a given work than if travelling at the rate of two hundred feet per minute.

Charcoal is sometimes used as fuel in the steam carriage, but more usually coke; there would be great economy in using coal, but the smoke would prove an annoyance on the road. Mr. Gurney asserts to have made experiments on a large scale, in which he found that smoke could not be completely consumed by any draught; he supposes the particles of carbon to be so surrounded by carbonic acid as to prevent combustion, requiring this gas to be removed before smoke can, by a supply of air, be entirely consumed.

In relation to the explosion of boilers, Mr. Gurney is of opinion that they are produced by some new and at present unascertained compound of hydrogen, oxygen, and nitrogen.

The explosive compound is supposed to be formed at high temperatures, and to come in contact with substances capable of decomposing it, when an explosion is produced.

This idea is supported by a reference to certain opinions of Gay Lussac, that there *may be* compounds of hydrogen and oxygen yet undiscovered; a very philosophic admission from which Mr. Gurney draws, in a strange manner, authority for this new compound. He asserts that there is but one compound of hydrogen and oxygen acknowledged in England, though two are admitted by French chemists; any elementary work would have corrected such an idea, and would also have shown him what are the "certain substances" by contact with which the deutoxide of hydrogen may produce explosive effects.

Mr. Gurney gives an account of the explosion of a cauldron in a brewery, which he advances to prove his hypothesis, suddenly leaving it when we suppose him about to draw the conclusion. He reasons thus; before the open cauldron exploded, a gelatinous matter had formed and prevented the contact of the water with the bottom of the cauldron, which thus became heated, and the compound was formed: now we expect the compound to explode, instead of which "the rupture of this film, and the sudden contact of water against the hot surface below, produced such an immense and sudden volume of steam that it burst the boiler." Exactly as the rupture of a film of dirt, or of carbonate or sulphate of lime would have done.

Mr. Gurney uses fusible plates to prevent the undue heating of the parts of his boiler, and a glass gauge to indicate the level of the water within, besides the usual stop cocks. His indicator of the pressure of steam is a weighted piston.

On ordinary roads it would not be reasonable to expect a steam carriage to draw more than its own weight. On ice the wheels require roughing; in deep snow the progress is very difficult; when ice is below the snow it becomes soon compacted, and the carriage passes forward readily.

Mr. Gurney goes into an examination of the benefits which would be derived from the substitution of steam power for horse power; the argument is true every where, but derives its force from the peculiar condition of England. We quote at length.

"I would state generally, in regard to the main improvements on steam engines, by which this country has been so much benefitted, and the prospects of advantages arising from steam carriages, that they have almost always been in a direct ratio with that of removing of horses; that the great and splendid improvements of Mr. Watt have generally been supposed to be principally connected with the separate condenser of the steam engine, and the saving of the fuel; but before Mr. Watt's day, we could empty our mines of water in Cornwall, and we could do a variety of other simple work by the steam engine, and so far the improvement of Mr. Watt was simply with respect to the saving of fuel; but I consider that the great national advantage arising from Mr. Watt's improvement, has been his application of the steam engine to machinery; and the extent of that advantage to the community has been in a direct proportion to the removal of horse power, a most unproductive labourer, and a dead expense to the country. If this view of the subject be entertained, the application of steam to propelling carriages on common roads, will be as important above its application to machinery generally, as the number of horses employed in locomotion exceeds that necessary to machinery, which bears no proportion with respect to each other. At Hounslow alone, there are at this moment upwards of 1,000 horses employed in stage coaches and posting. On the Paddington road, a distance of five miles only, there are upwards of 1,000 horses employed at this moment. Throughout Great Britain it is almost impossible to say how many horses are employed, but I should perhaps be within bounds if I were to say millions, in posting and stage coaches. If it is possible to remove those horses by an elementary power, which I firmly believe is practicable, the national advantage must be in proportion to the number of horses so removed; for if it is shown that one carriage horse can be removed from the road by the present state of steam carriages, I see no reason why every horse so employed should not be so removed. It has been decided that the consumption of a horse is equal to that necessary for eight individuals, so for every horse that is removed and is supplied by elementary power, we make way for the maintenance of eight individuals. If it is possible to carry the idea so far, and I see no objection to it, to do the principal work of horses by steam, or if it can be done by elementary power, the committee may imagine to what extent we may provide for our increasing population. I think we may do much by political laws and enactments, but natural laws will do more, and when pointed out by the finger of Providence, may be made to provide for his wise dispensations. I firmly believe that the introduction of steam carriages will do more than any other thing for this country. I have always had this impression; I left an honourable and lucrative profession, in which I was extensively engaged, in order to attend to this subject, because I was convinced of its importance and practicability; I have always entertained the same idea as I do at present. Imperfections will exist in the machinery; but I conceive that the main points of difficulty have been removed by the experiments I have made, and that all

those now remaining are practical difficulties, which will be removed by further experience; and if there is no cause opposed by the Legislature, or any other source, I will be bold to say, that, in five years, steam carriages will be generally employed throughout England. I have not hesitated, having these feelings, to devote all my time for the last six years to the subject, and am mentally recompensed by the present state of the subject. Private carriages also will be used. Under this opinion I have given directions for building a small one. I expect it will go quicker, safer, more easily, and certainly more independently than a common carriage, because it does not need the food of a horse."

To provide against accident in case the guide of the steam carriage should fall asleep, or be thrown from his place, Mr. Gurney has contrived to cause the steam valves to remain in gear only while the foot of the guide presses upon the apparatus. The same contrivance applies to moving down hill.

The next witness examined was Walter Hancock, also engaged in projects for locomotion.

Mr. Hancock states that he has been running his coach about twelve months, the stage is four miles, water being supplied at every eight miles. The quantity of water required for the eight miles is stated to be seven cwt. and of coke two bushels, or one-fourth of a bushel per mile. When the roads are good, the engine is worked at about seventy pounds per square inch upon the safety valve. The boiler used is Hancock's chamber boiler, and is thus described.

"There are flat chambers which are placed side by side, the chambers being about two inches thick, and there is a space between each two inches; there are ten chambers, and there are ten flues, and under the flues there is six square feet of fire, which is the dimension of the boiler top and bottom. The chambers are filled from half full to two-thirds with water, and the other third is left for steam: there is a communication quite through the series of chambers top and bottom; this communication is formed by means of two large bolts, which screw all the chambers together; the bottom bolts, the bottom part of the chambers, and the top bolts, the top part of the chambers; and by releasing those bolts at any time at all, the chambers fall apart, and by screwing them they are all made tight again. We have braces to fasten them; the steam is driven out from the centre of one of the flues, and the water is ejected from the pump at the bottom communication for the supply of water."

The iron of this boiler was an eighth of an inch thick.

In a carriage weighing 35 cwt. Mr. Gurney required 700 lbs. of water to go seven miles, and three and a half bushels of coke. Pressure about 70 pounds to the square inch. Mr. Hancock's carriage weighing from sixty to seventy cwt. consumes 784 lbs. of water in eight miles, (686 lbs. per seven miles,) and requires two bushels of coke (one and three-fourths bushels for 686 lbs.) to convert it into steam. Pressure as above. The economy would appear greatly in favour of Mr. Hancock's boiler (as .57 to 1,) if the number of either patentee can be relied on as more than a rude approximation.

In Mr. Hancock's carriage the passengers are in the front part of the coach, and the engine is between them and the boiler, which is placed behind. The guide is in front. The carriage weighs about seventy cwt., and carries ten passengers. Breadth of the tires about three and a half inches. Diameter of hind wheels four feet, but should be five.

Every part of the engine is upon springs. The power is communicated by two cranks, one attached to the piston of each cylinder. The cylinders are

nine inches in diameter, and the piston has twelve inches stroke. The carriage is sixteen feet long. The steam when escaping is thrown into the fire to prevent unpleasant noise, which is calculated, beside, to alarm horses on the road.

Mr. Hancock gives an instance of the bursting of one of the chambers of his boiler without noise or danger, and supposes them very safe, since steam is not allowed to accumulate in them, but is removed as fast as produced.

The carriage may be turned in an inner circle of four feet, and outer of ten feet radius. Mr. Hancock thinks that by reversing the motion of the engine he could stop, when going at the rate of eight miles an hour, in about twelve feet, or even in four feet.

A system of tolls is thought best which shall charge stage coaches in proportion to their weight, or to the number of passengers which they can carry.

In overcoming a hill, which is mentioned, the difficulty of forcing the coach up in frosty weather, by the adhesion of a single wheel, is spoken of. When the roads are neither very wet nor very dry, the travelling is the most unfavourable.

Mr. Hancock thinks that the fare could be reduced to two-thirds of that asked by the stage coaches, and that 100 miles could be accomplished in ten hours, including two hours of stoppages.

The evidence of Mr. Farey we propose to give somewhat in detail; as an engineer his name is well known, and having no share as a patentee, nor any direct interest, in the various projects, his evidence may be regarded as professional in its character, and without any special bias. Hence his remarks upon locomotion in general, upon the relative advantages of the different plans, upon the manner in which it may be helped forward by the government, &c. are of special interest. His evidence is less interrupted by queries, and the information better put together than those of the patentees.

"Have you turned your attention to the subject of propelling stage coaches or other carriages, by steam power on common roads, instead of by horses? I have had occasion to prepare specifications of several such inventions for which patents have been taken out, and have, in consequence, paid a close attention to that subject. I have also been consulted to settle the plans for the practical execution of steam coaches, but I have not directed or superintended any such execution myself. Of the specifications I have prepared, three have been followed up by building coaches, which have actually travelled on common roads; viz. Mr. Gurney's, Mr. Hancock's, and Messrs. Heaton's. I believe those three are the only trials, amongst many others, which have had so much success as to have been persisted in to the present time. I have examined other steam coaches, but they had no chance of success, and have been abandoned.

"Will you state, generally, your opinion as to the probability of this mode of propelling carriages superseding the necessity of using horses? All that has been hitherto done, or which is now doing, in that way, must, I think, be considered as experimental trials. I have no doubt whatever but that a steady perseverance in such trials will lead to the general adoption of steam coaches, and that, at an earlier or later period, according to the activity and intelligence with which an experimental course is conducted; and I am firmly convinced that the perfection which is essential to their successful adoption will never be attained by any other course than that of reiterated trials. The difficulties with which the steam coach inventors are at present contending, are chiefly of a practical nature, which I think, are not likely to be avoided by any great efforts of genius or invention; but I expect that they may be surmounted one after another by the experience which may be gained by competent mechanicians in a course of practice. I do not look for much more invention as necessary to the establishment of steam coaches; but it is certain that the practice is indispensable.

Each of the three inventors I have named has brought his steam coach to that state which renders it a full sized model for making such experiments as serve to prove the principle of action, and to teach how a better coach may be made the next time, but nothing more. The probability that such next better coach will be sufficiently perfect to answer as a trading business, depends as much upon the natural judgment and acquired skill of each inventor, as upon the qualifications of his present production."

"Has the experience which has already been had of steam carriages been such as to enable us to say that it is not merely in theory we have calculated on these carriages? Yes: what has been done by the above mentioned inventors, proves to my satisfaction the practicability of impelling stage coaches by steam on good common roads, in tolerably level parts of the country, without horses, at a speed of eight or ten miles an hour. The steam coaches I have tried, have made very good progress along the road, but have been very deficient in strength, and consequently in permanency of keeping in repair, also in accommodation for passengers and for luggage; for which reasons they are none of them models to proceed upon to build coaches as a matter of business. From the complexity of their structures, and the multiplicity of pieces of which they are composed, it is impracticable to give them the requisite strength by mere addition of materials, because they would then be too heavy to carry profitable loads as stage coaches. I do not consider that it is now a question of theory, for the practicability I conceive to be proved; but many details of execution, which are necessary to a successful practice, are yet in a very imperfect state. My view of the subject will be best understood by stating, that I believe an efficient steam carriage might now be made merely to carry despatches, by following the general plan of the best steam coach which has yet been produced, improving the proportions wherever experience has shown them to be faulty, using the very best workmanship and materials, and giving a judicious increase of strength to the various parts which require it, allowing all the weight of a load of passengers and luggage, and of the accommodations for them, in additional strength of materials, so that the total weight of the coach, without any passengers or goods (beyond the people and stores necessary for its own use and one courier,) should be as much as the weight of the previous model containing a full load of passengers and luggage. If three such coaches were constructed, one of them might start every morning at each end of any fair line of road 100 or 120 miles long, and one would arrive every evening at each end of that line in less time than a common stage coach; and I should expect that, after twelve months' perseverance, and after making all the improvements and alterations in the machinery which so much experience would suggest, the double passage ought to be made with as much safety and punctuality, and with much more expedition, than by the mail. The road between London and Bristol might be taken as a suitable line, but I should expect a pair of horses to be provided at every notable hill, to help the steam carriage up it. Such a proposition, it is obvious, offers no inducement to individuals, because it would be all expense without any return; but if it were judiciously done at public expense, I have no doubt but that it would lead to as much improvement in the mode of execution of future coaches as would enable them to be run permanently as stage coaches with profitable loads. The great defect of all the present models, is want of strength to resist the violence to which they are subjected in rapid travelling with a full load; and if that strength were given upon the present construction by the mere addition of materials, they would become too heavy to be efficiently propelled, even if they carried no load in them."

"As far as your experience has gone, which plan of steam carriage do you think will hereafter be most generally resorted to, that of an engine carriage drawing after it another carriage containing the passengers, or of conveying the passengers in the carriage in which the machinery is placed? I have not had experience in drawing by two carriages, except by the analogy of what is done on rail-ways, and hence I feel some difficulty in speaking positively upon

that point. There are advantages and disadvantages to be considered in both modes, but all the mechanical considerations incline to one side, viz. to place the engines in the same carriage with the passengers. That plan will certainly be lighter than when two separate carriages are used, and also the weight will be laid on those wheels which are turned by the engines, as it should be, to give them a firmer adherence to the road; also one carriage will steer and turn much better than two, and will go safer down hill, and will be cheaper to build and to work."

"By that means great weight is saved? Yes; perhaps one-third is saved in exerting an equal power. In stating my opinion of the probability of a profitable result, after twelve months' trial of three coaches to run regularly two hundred miles every day, with despatches only, I contemplated that the engines and passengers would be, ultimately, in one carriage, because that plan has a most decided mechanical advantage in making progress along the road, and also in facility of steerage, and safety in going down hill, and fewer servants are required to manage one carriage than two. On the other hand, all the constructions that have yet been tried with one carriage, subject the passengers to more or less occasional annoyance from heat and noise, smoke and dust, and there is still an apprehension of danger from the boiler: hence passengers will invariably prefer to go in a separate carriage to be drawn by the engine carriage; that mode also offers a facility of changing the engine for another, or for post horses, in case it gets deranged, because the change may be made without unloading, and discomposing the passengers. For common stage coaches these are strong motives to use a separate carriage, and if it can be brought to bear in comparison with horses, that mode will probably be most generally adopted by the influence of the passengers, although the other mode will inevitably perform the best and attain the greatest speed of travelling."

"Taking the two machines of Mr. Gurney and Mr. Hancock in their present state, do you think them entirely free from defects likely to prove dangerous to travellers? I do not think the danger is at all considerable in either Mr. Gurney's or Mr. Hancock's: there are dangers in all travelling; but I do not think the amount of danger will be at all increased by substituting steam for horses, according to either of those plans."

"The question refers to the peculiar danger from the nature of the propelling power? I am not inclined to think that there is any peculiar danger which would be incurred by the change; and if the engines and passengers are not on the same carriage, I think the ordinary danger would, on the whole, be diminished."

"The question is with reference to the relative danger of travelling ten miles an hour when drawn by horses, and when propelled by steam at the same rate? The danger of being run away with and overturned is greatly diminished in a steam coach. It is very difficult to control four such horses as can draw a heavy stage coach ten miles an hour in case they are frightened, or choose to run away, and for such quick travelling they must be kept in that state of courage that they are always inclined for running away, particularly down hills, and at sharp turns in the road. The steam power has very little corresponding danger, being perfectly controllable, and capable of exerting its power in reverse, to retard in going down hill; it must be carelessness that would occasion the overturning of a steam carriage, which carries the passengers in the same carriage with the engines. The distinct carriage I consider to be much less controllable in turning corners and going down hill, but yet far more so than horses. The chance of breaking down has hitherto been considerable, but it will not be more than usual in stage coaches when the work is truly proportioned and properly executed. The risk of explosion of the boilers is the only new cause of danger, and that I consider not equivalent to the danger from the horses. There have been, for several years past, a number of locomotive engines in constant use on rail-ways, all of them having large high pressure boilers, very much more dangerous than Mr. Gurney's or Mr. Hancock's, whether

we consider the probability of explosion, or the consequence likely to follow an explosion, because, being of large diameters, they are less capable of sustaining the internal pressure of the steam; and, also, they contain a large stock of confined steam and hot water. The instances of explosion among those locomotive engines have been very rare indeed."

"Have you seen Mr. Hancock's last improvement? Yes; I consider Mr. Hancock's boiler to be much better for steam coaches than any other which has been proposed, or tried."

"If that boiler were to explode, it is understood that there would be no danger at all? It is very difficult to foresee that; at the same time, the risk of explosion in Mr. Hancock's boiler is certainly very much less than in the locomotive boilers which are in constant use on a large scale on rail-ways, and where we have proof that the extent of the danger is very small."

"Do you think his boiler might explode without the passengers knowing any thing about it? The metal plates of which the boiler is composed will burn through by the continuance of the action of the fire, and may crack or open so as to let the steam or water out of the boiler and disable the coach from proceeding, but that is hardly to be called an explosion; no one would be hurt. The crack which lets out the hot water is sure in that case, to throw it into the fire and not on the passengers."

"You consider the danger to passengers by the chance of bursting of a boiler as not equivalent to the danger of horses running away? It is not equivalent, in my opinion; the probability of a coach being overturned by the horses is far greater than that of a boiler bursting, and when either accident does occur, the probable extent of mischief from an overturn in which all the passengers must participate, is much greater than could be expected from the bursting of a boiler, which must always be kept at a considerable distance from the passengers on account of the heat."

"Supposing either Mr. Hancock's or Mr. Gurney's boiler were to burst; in the one case the boiler being in a separate carriage, and in the other, the boiler being at considerable distance behind the passengers, what danger do you think could arise to the passengers from the bursting of the boiler? There is very little difference between the two cases: the separate carriage obviates any apprehension that passengers could entertain from the danger of explosion, and will therefore be preferred by most passengers; but, for myself, I do not rate that risk so high as to be induced to encounter the complexity of the two carriages, and to forego some of that new security compared with horses which steam power offers by its controllability in descending hills and turning corners; and from which circumstance, as I have before stated, I think the plan of one carriage is much to be preferred, and probably the other objections, of heat, and noise, and dust, may be overcome by some new means, which have not yet been shown. In Mr. Hancock's carriage the boiler is quite behind, and away from the passengers, so that they are out of danger, if there is any, and are not materially annoyed by heat, or smoke, and dust, except at times when the wind brings it forward, and that rarely happens when the coach is moving."

"Is not the danger attendant on the bursting the boiler greatly diminished by the subdivision of its internal capacity into tubes, or small and flattened chambers? Unquestionably, until the danger of explosion has become exceedingly small; but the great difficulty of boilers for steam coaches is, that the liability to burn through the plates has been increased by that expedient for ensuring safety; and the progress of the invention has been impeded between those two difficulties, in a greater degree than from any other circumstance. It was a desideratum for a long time to contrive a boiler, which, being made of such thin metal as would not render it too heavy, should have sufficient strength to retain high pressure steam without danger of bursting; also that it should expose a sufficient external surface of metal to the fire and flame, and of internal surface to the contained water, to enable the required quantity of steam to be produced from such a small body of water as could be carried, on account of

the weight: both these conditions were fulfilled by subdividing the contained water into small tubes, or into flat chambers, which expose a great surface in proportion to their internal capacity, and admit of being made strong with thin metal; but there is also another condition which is rather incompatible with the two former, viz. that there shall be such a very free communication between the interior capacities of all the tubes or narrow spaces, as will combine them all into one capacity, and permit the contained water to run from one to another, and also permit the steam, which is generated in innumerable small bubbles within the narrow spaces, to get freely away from them, and go to the engines without accumulating and collecting into such large bubbles as would occupy the spaces and displace or drive out the water before them; for, if that effect takes place, it produces three great evils; the water boils over into the engines along with the steam, and is wasted, and the thin metal which remains exposed at the outside to the fire, becomes burning hot in an instant, after the water is so driven away from the internal surface, and the further production of steam is suspended so long as the water continues absent. If such displacement of the water takes place frequently, and in many of the narrow spaces at once, the boiler will not produce its proper quantity of steam, and the thin metal will soon be burned through, and destroyed by the fire."

"Have you seen Mr. Hancock's boiler? Yes; I have had many trials of it; and I am well acquainted with Mr. Gurney's. The former uses flat chambers of thin iron plate, standing edgeways upwards over the fire in parallel vertical planes; the latter uses small tubes (such as gun barrels are made of,) to contain the water, the fire being applied on the outsides of the tubes. In Mr. Gurney's boiler I think the subdivision of the water into small spaces is carried too far, because the steam cannot get freely away out of such small tubes as he uses (and they are also of great length) without displacing much of that water which ought always to be contained within them. By an ingenious arrangement of connecting pipes and vessels, which he calls separators, he collects all the water which is so displaced along with the steam, and returns it again into the lower ends of the same tubes, and thus avoids the evil of water boiling over into the engines; but that makes only a partial remedy for the diminished production of steam, which is attendant on the absence of the water from the heated tubes, and the still greater mischief of burning and destroying the metal. Hence the evil of burning out the tubes is very great. Also his separators hold a considerable weight of water, from which no steam is generated; and they require to be heavy in metal, to render them quite safe and strong. Mr. Hancock has taken the middle course in subdividing the water in his boiler, having all that can be required for safety, and the weight, I believe, on the whole, to be less than that of any other boiler which will produce the same power of steam; for, owing to the freedom with which the steam can get away in bubbles from the water, without carrying water with it, the surface of the heated metal is never left without water. Hence a greater effect of boiling is attained from a given surface of metal and body of contained water, and that with a much greater durability of the metal plates, than I think will ever be obtained with small tubes."

"Do you think there is a danger of such an explosion as could do injury from the mode in which Mr. Hancock's boilers are constructed? That danger I hold to be very slight; the metal of Mr. Hancock's chambers will burn through in time, the same as that of Mr. Gurney's tubes will do, but not so soon. I think, taking the thickness of metal to be the same in both cases, no injury will be done by such burning through. The flat chambers in Mr. Hancock's boiler are very judiciously combined, and are secured against bursting by causing the pressure which tends to burst each one open, to be counteracted by the corresponding pressure of the neighbouring chamber, and the outside chambers are secured by six bolts of prodigious strength, which pass through all the chambers, and unite them all together so firmly that I see no probability of an explosion. Mr. Gurney's vessels, called separators, are secured by hoops round them, and, being of a small size, may be made very safe. Hence I think the

two boilers may be put on a par as to their security; but there is a decided preference, in my opinion, of Mr. Hancock's form of subdividing the water and steam compartments, which I believe is carried too far in Mr. Gurney's tubes, whereby the water included within the several tubes, cannot make way to allow the bubbles of steam to pass by it. This is owing to the great length and the small bore of the tubes; and they are so isolated one from another, that the water within them is not able to act as a common stock of water, or to keep all the interior surfaces of the metal tubes thoroughly supplied with water: thence, there is a deficient production of steam and an unnecessary destruction of metal."

"Are you aware that in Mr. Hancock's carriage, the waste steam, which is discharged from the engines after having performed its office, is thrown into the fireplace, and makes its escape upwards along with the flame, smoke, heated air, and gas, which ascend from the fire, to act on the boiler? That is the way in which he gets rid of the waste steam which the engines discharge, and I understand that he thereby avoids the puffing noise and appearance of steam which is common with high pressure engines. Mr. Hancock blows the fire with a current of air produced by a revolving fanner, which is turned rapidly round by the engines, and therefore he requires no tall chimney to produce a draft. Mr. Gurney formerly used a fanner to blow the fire, and also a chimney of some height; but I understand he has lately laid the former aside, and adopted the plan of carrying the waste steam, which has passed through the engines, into the bottom of the upright chimney, and there discharging that steam through a contracted orifice in a vertical jet, which, by rising upwards with great velocity in the centre of the chimney tube, gives a vast increase to the draft of heated air and smoke in the chimney tube, without any great height being necessary; and this plan occasions a most active current of fresh air to pass up through the fire, and urge the combustion. This is a most important improvement in locomotive engines, which has been introduced by Mr. Stephenson into his engines on the Liverpool and Manchester railway, and being there combined with an improved boiler, it has been one of the great causes of the brilliant success of that undertaking. I believe the same plan will be indispensable to the complete success of steam carriages; for chimneys cannot be used high enough to obtain a draft, and blowing the fire is a very troublesome affair. I fear Mr. Stephenson's plan would occasion more noise than is allowable on common roads; but that may perhaps be avoided, or diminished, by some new expedient."

"Do you think any danger would arise from the waste steam being discharged over a large mass of fire on Mr. Hancock's plan? Not the least danger; all the waste steam which blows off at the safety valve, and which the engines do not require, is got rid of in the same way; but I expect Mr. Hancock does not help the combustion of the fuel by thus mixing the waste steam with the flame before it acts against the boiler. Mr. Stephenson's improvement, which Mr. Gurney has adopted, is to discharge all the waste steam into the bottom of the upright chimney with a violent vertical jet, in order to accelerate the draft up the chimney. The waste steam, therefore, is mixed with the smoke and gas, after the smoke has ceased to act on the boiler. The waste steam was very commonly discharged into the bottom of the chimney, in Trevithick's high pressure engines, many years ago, in order to mix with the smoke ascending in the chimney, and thus to get rid of the waste steam; it improved the draft in that way, by rendering the smoke more buoyant, though only in a slight degree; but the waste steam was not discharged through a contracted orifice to give it velocity, nor was it directed upwards as is now done by Mr. Stephenson; whose vertical jet of steam in the centre of the chimney, gives such an intensity of draft through the fire as was never procured before, and, with the further advantage, that the rapidity of draft so produced, increases whenever the engines work faster, and discharge more steam, just in proportion as the demand for fire and steam increases by that faster working.

"Is there any noise occasioned in that way? Yes; but the sound is directed upwards by the chimney, and is not much heard in the locomotive engines on the rail-way when they are in the open air, but when they pass under the bridges, the sound is reverberated down again by the arch, and then it sounds very loud. The noise is no great consequence there, and no particular pains have been taken to avoid it. The metal pipe of the chimney has something of the effect of an organ pipe or trumpet, but it is probable the sound might be deadened."

"Will the burning out of the plates of Mr. Hancock's boiler, that you spoke of, be attended with risk of explosion of the whole boiler, or only of the smaller divisions of the boiler? It will be attended with no violence which could be called an explosion, nor with any danger whatever, but only with the inconvenience of disabling the carriage until the ruptured chamber is replaced by another. The rupture, or crack, of the metal plate at the burned place, would let out the water and steam very gradually into the fire, and probably extinguish it. All steam boilers burn out in that manner, sooner or later. The different chambers of Mr. Hancock's boiler are kept together by six very strong bolts, which pass through them all, and which are quite protected from the action of the fire; to burst the boiler those bolts must give way altogether, and there is no adequate force to produce any such effect."

"Are you acquainted with the construction of the new steam carriage which started this week from Gloucester to Cheltenham? I am not, further than that it is on Mr. Gurney's plan."

"Apprehension has been felt that these steam coaches will be found to give great annoyance to travellers passing them on the public roads, from smoke and the peculiar noise from letting off the steam; do you apprehend such results will take place? I do not anticipate any great annoyance will result to travellers in other carriages. I have passed Mr. Hancock's on the road several times, and Mr. Gurney's also, and have travelled in them often; horses take a little notice of them when in motion, but not much, and very soon become accustomed to them. I once met Mr. Hancock going very quick along the New road, and drew up to see him pass; I had no difficulty whatever in making my pony stand, though rather a spirited one. Mr. Hancock did not observe me; and as I wished to go with him, I turned and drove after him, and after a race to overtake him, I had no difficulty in drawing alongside of his steam carriage for a good way, in order to speak to him, and get him to stop for me. The emission of hot air was very sensible, when following close alongside of the boiler at the hinder end of the carriage, but I did not observe any puffing of steam."

"Do you think that whatever annoyance exists in the present steam coaches may be removed by the improvement of the carriage, and particularly the appearance of the carriage? Certainly their appearance may be improved; as they are now most unsightly. The general question of farther improvements in steam coaches depends upon the general mechanical skill and judgment of the mechanicians who turn their attention to the subject, and the peculiar experience they acquire in this particular branch of mechanics, by continually practising and exercising with steam carriages, on roads of all kinds, in all weathers, to find out their defects, and how to remedy them, and what is the best mode of management; also, by building new and better carriages as soon as they have learned what will be better than the present ones. But all this must be at a great pecuniary loss, and some further encouragement must be held out in order to induce the more skilful mechanicians to embark in such a pursuit; for, at present, it is by no means an object of attention to our best and most competent engineers, because they know they would only throw away their money and time by undertaking steam coaches, even if they were to succeed ever so completely. The patentees are a different class of men; they are the inventors who have first organized and arranged the combination of machinery which is to be used; and according to law, they have acquired a legal property in those

peculiar combinations which they have discovered, that has been their encouragement and stimulus to exertion; but the terms of their patent rights will be very likely to expire before their inventions come into use to such an extent as will repay them their previous costs with any profit thereon; and also, with the present defective state of the law on the subject of patents, they will be unusually lucky if they are able to make good their patents at law, in case their rights are contested. The patentees are not experienced mechanicians, or engineers, and have had to learn the business of engine making and of coach making as they went on; and a great deal of the deficiency of the present steam coaches has arisen from the circumstance, that they have been made by persons who were not at that time qualified to execute either a common coach or a common steam engine; but they have acquired more skill now, and we may expect more finished productions from them in future. There is no mechanician, of the class of those who will be ultimately employed to make the engines and machinery of steam coaches when they do come into use (and who alone can give that perfection of design, proportion, and execution, which is essential to their coming into use,) who will have any thing to do with them now; not so much from any doubts that they would not be able to succeed in perfecting them, as from a conviction that the expense of attaining success would be greater than would be repaid by any advantage they could afterwards derive from making such machines, in open competition with every other mechanician who chose to copy after their model when perfected; for the perfection of design, proportion, and execution, in which steam coaches are now wanting, though very laborious and expensive of attainment, would not be a ground of claim for exclusive privileges under the existing law of patents. The patents to the first inventors are the only ones which are professed to be recognised by law, though in effect they can scarcely ever be maintained at law. That is a very important point for the consideration of the committee, and one which deserves great attention. As the law of property in inventions now stands, when a new invention is advanced to such a stage that it may be considered to be tolerably perfect as an invention, no further exclusive privilege can be maintained to compensate for the skill, labour, and expense, which must be incurred to find out those true proportions, dimensions, weights and strength, which are essential to bring it to bear as a practical business. The law professes to give the whole to the first inventor, although he may have only laid the foundation on which another has raised the superstructure; and if, as usually happens, the claim of the first inventor is set aside, from technical informality in his title deeds, and also when his term expires, the whole superstructure lapses to the public. For these reasons, those who are the most competent to the task of giving the finishing touches of practical utility to great inventions, are kept back by being aware that they will not be repaid. Under such circumstances, a defect of judgment would be proved *a priori* against any one who might commence such an unpromising pursuit, and that want of judgment which could permit a man to overlook the pecuniary considerations, would not be favourable to his success as a mechanician, in giving that precision of form and dimensions, and that practical utility, to an invention which requires an exercise of the cool judgment resulting from experience, rather than of the genius depending upon original thought."

"You do not consider the inconveniences of the present steam coaches to be inseparable from the invention? Certainly not; but I do not think that any of the individuals at present engaged in the pursuit are the most competent persons who could be chosen to overcome the remaining difficulties, being inventors, who have almost completed their parts of the task, and not experienced practical engineers, into whose hands the affair of building the next steam coaches ought now to pass, under the general direction and advice of those inventors. If the building of steam coaches is continued in their hands, they will advance towards perfection of proportion and execution only by slow degrees, as the patentees acquire that general skill as engineers and mechanists which is already possessed by professional engineers."

"You think that the machinery may be improved by better mechanists? I have not the least doubt of it; and yet those mechanists are not the proper men of genius to have invented what has been hitherto done by the patentees."

"Apprehensions have been felt by trustees and surveyors of roads that steam carriages are more injurious to roads than carriages of equal weights drawn by horses; what is your opinion upon that point? I should not apprehend that the present coaches are injurious in a greater degree than other carriages of equal weights; and when steam coaches are really brought to bear, I think they will be much less so than any carriage at present in use, taking horses and the carriage they draw, against engines and the carriage they impel, at weight for weight. All my observations upon steam carriages have led me to believe that they do no particular harm to the road. I could never perceive any particular marks that they left in their tracks, and an examination of the iron tire on the edges of the wheels of Mr. Hancock's carriage, shows, evidently, that no slipping takes place on the surface of the road; which fact is proved to a certainty by other observations on the working of that carriage. It will be a long time before a sufficient number of steam carriages travel over any road to bring their effect on the materials to the test of experience; but, on general principles, I have no hesitation whatever in stating my opinion that they never will answer as long as they do injure the roads any more than the fair wear occasioned by the wheels of other carriages of the same weight; for any injury they might do to the road must be by the slipping of their wheels on the road, which would be a waste of the power of their engines, and hitherto they have had no power to spare; or, if their wheels are too narrow, and they cut deep into the road, the power of the engines will be wasted. If they are to be efficiently advanced, the whole power must be fairly exerted in advancing them forwards along the road, without turning their wheels in vain on the road, or cutting ruts in it. I am confident that, if the wheels slip at all on the roads, so as to lose motion, or if they penetrate so as to make ruts, those coaches will not answer; and therefore that the defects must be remedied, or the coaches given up. I do not mean to affirm whether the present steam coaches which draw other carriages after them, do or do not slip on the road, because I have not examined them; but I am of opinion that, for the ultimate successful application of steam power, the carriages must be so constructed that they will do less injury to the roads than carriages drawn by horses; and whenever steam coaches become common, I think the roads will be most materially benefitted by the change."

"Supposing the total weight of a stage, or mail, coach, drawn by four horses at ten miles an hour, to be two tons, and the weight of the four horses to be two tons, what proportion of the wear of a Macadam road would you expect to be occasioned by the wheels of the coach, supposing them to be the usual breadth of stage coach wheels, and what would be the wear by the horses' feet? It is impossible to fix an accurate proportion for such a question; but I have no doubt that, weight for weight, horses' feet do far more injury to a road than the wheels of a carriage, and particularly so at quick speeds, because wheels have a rolling action on the materials of the road, tending to consolidate, and the horses' feet have a scraping and digging action, tending to tear up the materials. One test of the wear by horses' feet will be in the wear of towing paths for canals, and the rail-way roads where horses are employed. In either of those cases, the number of horses which pass along is so small that no turnpike roads afford any example of comparison, and yet the wear of towing and rail-way paths is found to be considerable. The rapid wear of horses' shoes is another test."

"It has been stated, by a previous witness, that the proportion of the wear of a Macadam road, under such circumstances, would be about two-thirds by the horses, and one-third by the carriage; should you think that a fair approximation to the truth? I have no means of judging with such precision, but I have no doubt whatever that, in the case above supposed, the wear by the horses' feet would be much greater than the wear by the wheels; for, independently

of the difference of the action, as before stated; the rapidity of the blows wherewith the horses strike down their feet, in stepping quickly, wears the road, and they keep their feet pressing on the same spot for a sensible time afterwards, which must have a far greater effect on the materials, to wear and loosen them, than the comparatively progressive rolling of the wheels over the road, because the latter remain only an imperceptibly short space of time on the same spot, and have a consolidating action.

"May you take the wear of horses' shoes, in proportion to that of the tire of the wheels, as a fair test of the proportionate wear of the road by each? No, by no means; because the pressure which the wheels exert, and which wears away the tire, is, under certain conditions, very beneficial to the road; whereas the pressure occasioned by the horses' feet is in all cases pernicious. On a gravelled road, which is not yet consolidated, the rolling action which causes the wear of the tire of wheels produces a great improvement of the road, when the treading action, which causes an equal wear of horses' shoes, does nothing but mischief. The harder and more solid the road becomes, the less this may be apparent, because the wear of the road becomes so imperceptible; nevertheless, I think the proportion of less wear by wheels than by horses' shoes, will still hold true.

"What is the average width of the tire of the wheels of steam carriages which you have tried? Mr. Hancock's wheels are two inches, and three inches, broad; in Mr. Gurney's carriage, when he carried the lead along with the engines, the wheels were two inches and a half broad; but I understand he has widened them since he has altered his system of drawing a separate carriage, which is to be expected as a necessary consequence of the alteration.

"Do you think the machine would act with less advantage if the wheels were wider? That depends entirely upon the weight resting upon the wheels, and the sort of roads they are to run upon. I think it would be better for those individual carriages to use broader wheels than they had.

"If the tire of Mr. Hancock's were six inches broad, would it be an advantage or a disadvantage? I think six inches would be too wide for that description of carriage; about four inches I should think a suitable width for his wheels. Mr. Hancock's carriage is so arranged, that a greater proportion of the whole weight of the carriage is thrown upon the hinder wheels, to one or both of which the power of the engines is applied, than upon the fore wheels: which I think is very judicious, because it ensures such an effectual adhesion of the hind wheels to the road, that no slipping can take place. The breadth of the wheels must be so proportioned to the pressure they exert on the road, that they will not so indent or press in, as to leave deep marks behind them. The actual breadth that will be suitable to any given weight will depend upon the hardness of the materials of which the road is made, and roads differ very much in that respect. I think that, in all cases, the breadth of wheels which will enable the carriage to make the best progress, will be that which will do the least injury to the road, for it will be that which will occasion no disturbance of the stones after they have been consolidated, but will only wear away their upper surfaces, and the iron of the tire.

[TO BE CONTINUED.]

¶ On Working Iron and Steel.

(Concluded from page 200.)

From what has now been stated, it will be seen that there are two causes for the failure of steel, more particularly if used quite hard. The first is an unequal combination of carbon with the iron, and this is more or less the case with all steel till sufficiently hammered; the toughness of some parts, the brittleness of others, and the differ-

ent states of tension hence arising, render the metal very liable to crack, if not in the hardening, yet afterwards, when forcibly struck as metal dies are.

The second cause is bad hammering; for I think I have shown above, that however much hammered, it yet may be left in a most violently conflicting state, some parts girded and pressed, while others are as powerfully strained, almost to breaking; and if hardened in this state, how can it be expected to stand? and thus springs, though very equally formed, may be very unequal in their strength.

Well hammered steel requires the least tempering to give it the necessary degree of toughness; but when hardened from a great heat, it loses all the previous condensation from the hammer, and with it so much strength that the toughness disappears, and the same hardness with less strength shows itself in brittleness. Steel, therefore, of this inferior strength, requires more letting down by tempering, to arrive at a sufficient degree of toughness to bear using. Such tools are too weak and soft for turning steel or iron, and do not stand long for any purpose.

I believe there is a given degree of cold to which the steel must be brought in a given time, to cause hardness; also a given degree from below which steel will not harden; and that all farther increase of the heat only weakens the steel, and all further increase of coldness serves only to harden a greater mass, or a deeper coat of a large mass, by cooling it in the required time.

Steel much overcharged with carbon, is too harsh, or brittle, to receive all the improvement that hammering would otherwise give it; but by choosing the most malleable steel, already sound, and hammering it at a heat so low as to be capable of holding a coat of carbonaceous matter, it will imbibe the carbon so slowly and in such small quantities during each hammering, as to enable the workman to bring it up to the fullest charge compatible with sound hammering; and so far carbon must improve the strength; but beyond that, brittleness comes on, and it refuses to receive any condensation from the hammer, by which alone toughness is given. It is of no use seeking for hardness unaccompanied by toughness, for we should have to let it down to prevent breaking; yet many believe the hardness to be increased by coming up to this brittleness; therefore, taps, dies, and turning tools, in order to increase their hardness without losing toughness, are allowed to receive a little more carbon on their surface, by putting them in red hot carbonaceous matter for the hardening, the toughness of the metal within remaining the same. For this purpose animal charcoal appears best. I have chiefly used burnt leather, which seems capable of a sort of fusion on the surface of the steel while coming to a red heat, and therefore imparts the carbon much quicker than wood charcoal; and in all cases of hardening it is best to heat the steel in close vessels, or a case of some sort, to protect it from air and prevent carbon burning out of the surface. Water damages the surface at the moment of plunging; to prevent this, small articles are frequently plunged into oil or tallow, which has the reverse effect, for it rather restores the surface. Files, and other tools that do not admit of being sharpened, are left quite hard; also tools for

cutting steel; but in all other cases, to prevent the risk of breaking, the extreme hardness is removed by tempering more or less, as the intended work will allow.

Various methods have been resorted to, in order to measure the exact temper, and more particularly for long thin articles, such as watch springs, which are difficult to heat uniformly. Melted metal, the fusing point of which is just under the right temperature, has been used; but if the mercury, or other melted metal, be in sufficient quantity, and the heat be measured by a thermometer, it will secure accuracy: the article being moved about in this till of the same heat in every part, and all through, will be well tempered, let the shape be what it may.

Heating the articles in oil till the smoke rises copiously gives a good temper for tools for brass work, and a still lower temper is given when the oil catches fire—this is called blazing off; but for articles of any substance, colour is the simplest and most direct criterion. The hardened steel is ground clean along one side, and kept perfectly free from greasiness; it is then heated, in preference at the side of a fire to avoid smoke, carefully watching the bright part until it becomes of a straw colour, it may then be cooled in water to prevent the spread of heat from parts not cared for; this temper suits tools for brass work; but if heated till it becomes brown, bordering on purple, it suits tools for pewter and very hard wood; after this it becomes blue, indicating a suitable temper for the softest carpenter's tools, table knives, and springs; it is just low enough to bear filing, and in thin pieces will bend a little before it breaks; if heated beyond this it turns gray, and is almost visibly red in the dark. Very thin springs are observed to be stiffer while the blue colour is on than when cleaned off; and on re-bluing them, they regain their stiffness, although there is no alteration of the temper; such springs are therefore preferred with the blue colour on.

These colours may be given to hard or to soft steel, and when cleaned off, the same heat will always restore them. The steel and screws of watches are generally blued for ornament; the other colours, when given merely as a guide in the tempering, are cleaned off. I have found the slow conducting power of lamp black a useful agent to preserve particular portions from being hardened with the rest.

It is sometimes desired to harden the neck of a mandril and not the screw, lest it should break when roughly used: this may be done by an iron tube fitted a little way on the neck of the mandril, and ramming the space between full of lamp black, so as completely to envelop the screw, then shut it in by a disk to serve as a wadding; the mandril being then made red hot, and plunged in water, the exposed part will be hard, and the covered screw will remain soft.

Steel hardens as well under cover, as if exposed, provided it can be cooled in the requisite time; small articles, for watch work, have accordingly been hardened quite clean, and their brightness preserved, by filling a brass box with them, capable of being shut air-tight while in the fire, and then plunging the box with its contents in the water. On opening the box when cold, the articles are found hard

and clean. Very fine drills or wire may be hardened from the flame of a lamp or candle, by merely shaking them quickly in the air, as that will cool them soon enough. Large masses require rapid motion in cold water to enforce their cooling in the requisite time. The largest masses that can be hardened are best done under a waterfall, the force of which beats away the steam as fast as formed, and keeps the surface cool while the central heat is escaping through it; and they should remain in this situation till quite cold throughout; if taken out sooner, the central heat will spread to the inner side of the hard shell and expand it, while the outside may be cold, and therefore will be liable to burst.

I met with an evident case of cracking, when hardening from badly hammered steel which also was unequally carbonized. The pieces were ovals, one inch long, filed out of steel bars one-tenth of an inch thick; they were then hammered, which condensed the middle and stretched the outside; in this state, they were heated in a crucible full of charcoal powder, (which probably carbonized the outer edge most,) and hardened by plunging in water; this cracked them all in the middle, the most condensed part, and none of the cracks extended to the outside.

Stamps and medal dies are an important application of steel; and to enable them to be hardened sound, and to stand in use when hardened, requires the metal to be in a state of perfect ease, the result of equal condensation all through, and this can best be secured by hammering in a recess.

For this purpose, it would be very desirable to ascertain, by experiments, the greatest thickness that can be hardened all through; also the state of carbonization most favourable to the greatest thickness; or, what is the precise difference in this respect between the most mild steel and that which is highly charged with carbon. Likewise, in very large masses, what is the greatest depth from the surface that can be hardened, and whether greatly hammering it would cause any difference in the thickness of the hard crust. This would of course require the pieces so hardened, to be afterwards broken to examine the interior; and where a soft nucleus occurred, it would require to be ground flat, to show what sort of boundary there would be between the hard and the soft parts; for it would be rendered visible by the very different texture which grinding produces in hard and in soft steel; and there must be some difference in the durability of a block, according as the boundary is well, or ill, defined.

We are so familiar with small flaws in articles of iron as scarcely to notice them, for their cheapness enables us to use the good and throw away the bad—such as nails, brads, screws, &c.; but our attention is drawn to large flaws, from the serious consequences likely to attend their giving way.

But in steel nearly the reverse takes place, as it is used so much smaller than iron, in things of consequence; therefore the smallest flaws are frequently of as much importance as the largest, for they occasion the breaking of tools, frequently spoiling the work; and when

small work is nearly finished, hidden flaws destroy it; they also help to crack large masses when hardening.

But when the utmost efforts of the human mind are transmitted to steel plates, from which the delights of peace and civilization are spread abroad, it becomes of the greatest consequence to avoid every flaw, and even chemical dissimilarity; for though the metal be sound, it may be so unequal in its nature as to etch very badly, and the smallest flaws will spread very broad while drawing into thin plates; and when the etching, or graving, reaches through to such a flaw, the work is spoiled; laminæ of engraved work frequently coming off, as engravers have already seriously experienced.

For such works, therefore, cast steel should be employed: it should receive an extra degree of forging, most perfectly to equalize its composition, and reduce it to a mild state, for on this depends good etching; then the surface should be watched and kept clear, while reducing it to a usable thickness, that no flaws may be beat in: all welding must likewise be avoided, for fear of shutting in flaws; and if rolled into plates, it will require good hammering afterwards to restore the strength, or soundness, which it loses laterally while rolling. The especial reason why the primary forging should be long and carefully performed, is, that the etching is liable to be rough or smooth, as perfect homogeneity is more or less obtained, and it will be cloudy if different parts of the plate differ in their dose of carbon.

It would be desirable for engravers to make themselves well acquainted with the difference of action of the same acid on pure decarbonized steel, on ordinary steel, and on highly carbonized steel, and also on steel in the softest as well as in the most condensed state; for they would thus judge better whether the defects were in the metal or the acid.

Cornelius Varley.

[*Trans. of Soc. for Encouragement of Arts.*

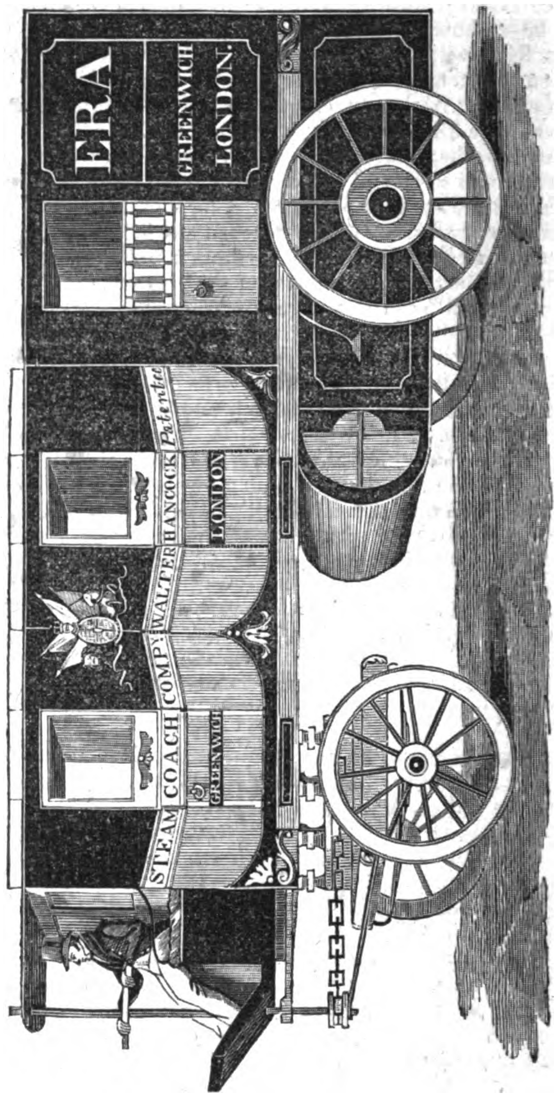
¶ *Iron Roofing.*

Your correspondent, at Peterhoff, has not given you the best mode of covering an iron roof, to prevent its rusting. Coal tar, brought to 220 degrees of Fah. and mixed with red lead, (genuine,) in the proportion of eight of tar to one part of lead, forms a composition which resists oxidation of the iron plates, or wrought iron of any shape, better than any other material whatever. Oil, and every mixture of metallic oxides with oil, give to wrought iron a tendency to scale off in large flakes when subjected to changes of temperature. At the present price of iron, it is much cheaper to cover a roof with sheets of that metal than with any other material whatever—and more especially where the plates are coated under and over with the above composition. Fine sand must be strewed on the surface, quite dry, and the work must be executed in dry weather.

[*Mech. Mag.*

¶ *Hancock's Steam Carriage.*

The annexed engraving represents a new steam carriage, which Mr. Walter Hancock has just built to run on the road between London and Greenwich.



For the following particulars of its construction, we are indebted to Mr. Gordon's valuable Historical and Practical Treatise.

There are two engines, which are placed before the boiler and turned with the stuffing box down, so that the cylinders are uppermost, and the piston and connecting rods below. The crank shaft, with two cranks, is supported by a flexible frame, which provides for any concussion on rough roads. A chain passes over a sheave on the crank shaft, and over a larger sheave on the hind axletree. The wheels turn loose on the axle, and one or other, or both, are fixed by a clutch when required. This clutch is on the outside of the wheel, and can be screwed out, or in, as the case demands, with great facility. The turning of the carriage round to the offside, is prepared for by throwing out the off side clutch, and keeping in the near one; and the turn round to the near side, is prepared for by throwing out the near clutch, and throwing in the off side clutch. A little play is left between the catches in each clutch, so that a winding road may not oblige either wheel to be disengaged; and it is only in a short turn, or a turn round, that the clutch must be shifted, and this can be done in a very small space of time.

Fig. 2.

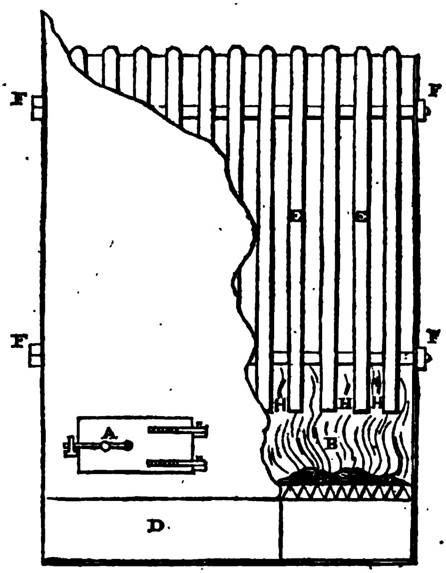


Fig. 2 is an elevation of the boiler, with part of the casing removed for the purpose of exhibiting the interior structure. A is one of the fire doors, of which there are two. B the fire place; D the stokehole; E E the chambers, constructed of the best wrought iron; F F shows the manner in which all the chambers are bolted together, so as to form a large boiler of many compartments. There are fillets of iron, which keep the individual compartments at a proper distance

from each other; and these spaces which the fillets leave are the flues of the boiler, through which the flames ascend as shown at H H H. All these compartments are connected at the bottom for the purpose of keeping the water in each at the proper level; and at the top the steam is conveyed from each by as many pipes as there are chambers into the steam feed pipe, by which the steam is conveyed to the engines. By this arrangement, the only parts of the boiler which can be dreaded are the sides; but good ties will keep them together. And as to the bottom end, and top of the boiler, which are composed of the edges of these compartments, if one part is burnt out or hurt, it is only that individual compartment which can burst, and its power of doing mischief is not worth notice. The fire is urged by a blower, which is driven by a connexion with the engines. The waste steam is blown from the engines into the chimney, and so destroyed. The passengers are carried on the same machine, Mr. Hancock preferring that disposal of the weight to the dragging of it in a carriage behind. The wheels of the carriage are a beautiful exhibition of strength and lightness combined. The spokes are all wedge shaped, and where they are fastened into the nave, abut against each other. Their escape laterally is prevented by a large iron disc at each end of the nave; and these being bolted through, confine the spokes securely in their places.

[*Mech. Mag.*

¶ *Mr. Gurney's Steam Carriage, applied to rail-ways.*

We have been favoured with the following copy of a letter from William Crawshay, Esq. to Lieutenant-Colonel Sir C. Dance—

Cyfaithfa Iron works, 23d February, 1832.

My Dear Sir,—I regret that my occupation at this moment prevents me giving you the ample reply I could wish, to your inquiry as to the working of Mr. Gurney's engine on our rail-road at Hirwain. I can, however, state to you in general terms, that the favourable opinion entertained by my engineer and myself of the tubular boiler, over every other we have yet seen, not only remains unshaken, but is strengthened and confirmed by eighteen months constant use and observation of it on our own road; and, also, by all we can collect from other testimony, of what is doing elsewhere in this neighbourhood with boilers of other description. The ease and economy of first construction, the facility of repair when required, the extreme lightness, the great capacity for raising steam, and the perfect freedom from danger of the tubular boiler, all render it, in our opinions, pre-eminently adapted to locomotive engines; and I hope in the course of a few months, to apply it to engines and carriages, suited to rail-roads and heavy work, so successfully as to render the advantage of steam power over that of horses, still greater than it now is. As, however, facts of past performances of any kind are more satisfactory than anticipations of the future, I beg to state to you, that in

the past twelve months, between the 1st day of January, 1831, and the 1st day of January, 1832, the locomotive engine which I bought of Mr. Gurney, weighing only thirty-five cwt. including every thing whatever belonging to it, with water and fuel in a working state, conveyed 42,300 tons of coal, iron stone, and iron, exclusive of the carriages on which they were drawn, the distance of two and a half miles upon our rail-road at Hirwain, in journeys of from twenty to thirty tons, as suited our convenience; during which time the entire consumption of coal was 299 tons, which at 3s. per ton, amounts to £44 17s. The wages of the engineer £52, and those of the boy £15 12s. together, exclusive of the trifling repair of the engine, and the oil and other little matters required for its use, £112 9s. or less than one farthing per ton per mile, for the goods conveyed; and I must not omit to observe to you, that had there been nearly double the work to do on this road, the engine would have done it with little or no increased expense, as she was invariably working idle, for the purpose of keeping the boiler full, about one-half of her time.

You are sufficiently acquainted with the experience of horse power to render any comparison on my part unnecessary, but from the observations I have been enabled to make, in contrasting horse power with that of steam on the same road, I should certainly consider that the average of horse power, compared with that of steam under the most improved application, is, in point of expense, as twenty or even thirty to one: independently of many other valuable considerations in favour of that of steam, known only to those who have large and expensive stable establishments, in which valuable horses, after sustaining hard work all day, are exposed to the negligence, roguery, and ignorance of hawliers, horse-keepers, and farriers, while the engine, having completed her day's work, may be left without anxiety as to the attention of any of these notoriously troublesome persons until again called into use.

I consider that the unprecedented depression of the iron trade, and the late disturbances in South Wales, have much impeded the further introduction, use, and improvement, of locomotive engines in this part of the country; and it is a matter much to be regretted, that more talent, competition, and energy, are not at this moment excited every where in the furtherance of so great a national advantage as the substitution of the cheaper power of steam, wherever practicable, for that of horses.

Wishing you every success in your zealous perseverance in this laudable object.

I am, sir, yours, &c.

William Crawshay.

[*Mech. Mag.*

Swing Hone.

The thanks of the Society in London for the Encouragement of Arts, &c. were voted to Mr. J. Fayrer, of Pentonville, for his swing hone for sharpening razors and other articles of cutlery. One of the hones has been placed in the Society's Repository.

The exquisite edge given by the cutler to razors, lancets, and other fine cutting instruments, can rarely be produced by those persons who are in the habit of using them. This arises partly from ignorance of the properties in which consists the difference between a good and a bad hone, and partly from want of that skill and slight of hand in the use of a hone, which long and constant practice only can give in perfection. Mr. Fayrer's hone is a plate of brass, about an inch wide, and of any convenient length, ground to a perfectly smooth surface on both sides; part of each end is cut or filed away, leaving only two pins, or pivots, on which the hone turns or swings. In the frame are two uprights with notches to receive the pivots. Two boxes are provided, one to hold a coarser and the other a finer powder made of oil-stone ground down and washed over: for the latter, finely pounded water-of-Air-stone may be conveniently substituted.

To use the hone, first put on one of its sides a few drops of oil and a little of the rougher or coarser powder, then draw along it, in the usual manner, the edge of the razor or other tool to be sharpened. As the hone swings on two pivots, the surface necessarily applies itself quite evenly along the edge of the blade, in whatever direction the pressure of the hand is made that holds the tool; and the particles of the powder, as the operation proceeds, are continually becoming smaller and smaller, and therefore giving a finer and finer edge to the tool or blade. To finish the setting, turn uppermost the other surface of the hone, apply to it oil and the finer powder, and proceed as before.

Metal plates, both of steel and of tin, have already been made to serve the purpose of hones; but the application of brass as a material for this purpose seems to be new, as well as the contrivance of hanging it on pivots, in order to accommodate itself to the varying pressure of the hand. [*Trans. of Soc. for Encour. of Arts.*

TRANSLATIONS FROM FOREIGN JOURNALS.

New rollers for Inking Lithographic Stones.

[Translated for this Journal.*]

The rollers used in lithography for inking the stones, consist generally of cylinders of wood covered with calf skin, and stuffed with carded wool. Besides the inequalities which the surfaces of such rollers present, the seam uniting the two sides of the leather makes a ridge which spoils the uniformity of the inking, particularly when

* By request of the Committee on Publications.

large stones are used. This has hitherto been a great obstacle in the progress of the lithographic art. This ridge had been reduced, and practice had taught a method of concealing, in part, the defects necessarily attendant upon the use of rollers with seams; but the inconvenience and many defects still remained to be remedied. M. Tudot, incited by an appeal of the Society for the Encouragement of National Industry, conceived the idea of making rollers of round plates of different substances cut with a punch, then threaded together on a cylinder of wood, pressed forcibly one against the other, and polished or trimmed. He has tried in this way chamois leather, calico, and calf skin. This last material answered best, and furnished rollers which were soft, without seams, and which distributed the ink uniformly. M. de Lasteyrie, a competent judge in these matters, observes that the ordinary (seamed) rollers are very quickly worn out, while those of M. T. will not be exposed to the operation of the same causes of wear and tear, and will, therefore, greatly outlast the others.

The new rollers are rather higher priced than the common ones; but it is confidently expected that their continued manufacture will admit of a reduction in the price. M. Tudot has received a prize of 500 francs ($100) for the ingenuity displayed in his invention.

[*Mémorial Encyclopédique, &c.*

Method of removing Acid from the papers used in Lithographic Printing.

Most of the paper used in copperplate and lithographic printing has an acid reaction, due, doubtless, to the processes of whitening, or to the alum used in its manufacture. This acid soon injures the texture of the lithographic stones, and after, at most, thirty impressions have been taken, the stone *greases*, to use the expression of the workmen, and the impressions are imperfect. M. Joumar remedies this greasing of the stone, in a very simple way; he passes the paper intended to receive the impression, through weak lime water, which neutralizes the acidity; he leaves it through the night thus wet and *matted*, and on the following morning either dries it or takes off the superabundant moisture, keeping that degree of softness which the printing requires. The author of this simple and easy method of removing the acid from lithographic papers, has received a medal of the value of 200 francs, ($40.) [*Ibid.*

Lithography in imitation of Mezzotint.

Various attempts have been made to imitate the style of mezzotinto engraving by lithography. One of the methods tried was by *tamping*. This process had given some beautiful results, but the mellowness of the tints could not be obtained. Besides, in sketching

on the stones and removing the superabundant ink with the scraper, for the clear parts, the grain of the stone was destroyed, and when the stone was heated, for the purpose of fixing the sketch upon it, a few engravings with tarnished and gluey tints were all that could be obtained. M. Tudot proposes another process in which the scraper is not used. He lays the lithographic ink on the stone with care, makes it penetrate into the grain by means of an instrument of horn, then with a point of ivory, or, in preference, with a small utensil composed of very fine and pointed threads of steel, he takes from the bottom of the grain as much of the crayon as he thinks necessary to produce the desired tints. This process, put in practice by able workmen, has produced designs rivalling in every particular engravings which have come from the hands of the most celebrated engravers in mezzotint. The artist, while transferring to the stone the conceptions of his genius, has every desirable freedom, is not embarrassed with any mechanical operation, and the process is very rapidly executed. In some trials, made in presence of the Society for the Encouragement of National Industry, the 800th impression was as beautiful as the first. M. Tudot has received for this application a gold medal of the value of 2000 francs, ($400.)

[*Bulletin of Soc. for Encour. of Nat. Ind., &c.* 20 *Dec. and Ibid.*

Cure for Painter's Colic.

Plumbers, manufacturers of white lead, painters, printers, &c. and, generally, all persons exposed to the action of lead, are subject to this colic. Many remedies have been employed in this complaint; the one most generally adopted, and which has been attended with constant success, consists in administering emetics and purgatives. This method is obviously troublesome, and is besides expensive. M. Gendrin has communicated to the Academy of Sciences, a new remedy, viz. the acid sulphate of alumina and potassa, or common alum, dissolved in a sufficient quantity of water, and given in a dose of from one to three grains a day. This mode of treatment had been before recommended by Adair, Michaelis, &c. and is now in general use at the hospital of St. Anthony. The alum thus taken cures the malady completely in the space of from three to five days, without in the least weakening the organs of digestion. Its use in a dose of from one to one and a half grains,* is still more beneficial at the commencement of the attack; twelve or fifteen hours are then sufficient to remove all the symptoms. M. G. considers the efficacy of the alum to be probably due to the sulphuric acid, which enters into its composition. In fact, a sulphuric lemonade, made of one gros† to 1½ of acid, in twelve litres‡ of water, given to persons suffering under the painter's colic, has produced a complete and speedy cure. The sulphuric acid thus used with water as a lemonade, is as well as the alum, a sure preventive if taken on the first symptoms of the

* French, 2-3ds of a grain troy. † 54 troy grains. ‡ 25½ pints.

attack. If these simple receipts for the prevention and cure of a terrible complaint, are supported by further experience, M. G. will have rendered a great service to many useful and laborious classes of manufacturers and artists. [*Ibid.*

Prizes awarded by the Society for the Encouragement of National Industry.

On the 28th December the Society for the Encouragement of National Industry held its public semi-annual meeting for the year 1831. Of twenty-one competitors for the prize offered for the best means of security against the explosions of steam boilers, and for such a form of boiler as would guard against the effects of such explosions, no one obtained the prize. Silver medals were awarded to the following persons—M. Hall, of Paris, for a combined safety valve and fusible plate: M. Roux, for a new kind of feeding pump; and M. Trimot, engineer and maker of steam engines, for his water gauge tube, and fusible plate applied to the boiler. [*Ibid.*

Laws of Friction.

Notwithstanding the ability of Coulomb, and the care which he bestowed upon all his experiments, his researches upon the subject of friction, the results of which are given in the memoirs of the French academy for 1785, were incomplete, and, in some respects, contradictory, and their accuracy has been, in consequence, suspected. The researches since made upon the same subject by Rennie, Vince, and others, have neither been sufficiently extensive nor precise to set the question at rest. Mr. Morin, by means of an apparatus better calculated for giving precise results than that of Coulomb, has lately made a new set of experiments, varying the velocity from the lowest up to ten feet and upwards a second. The rubbing surfaces also varied from some tenths of a square inch to nearly five hundred square inches, and the pressures from ninety pounds to 2000 lbs., and were carried even as high as 2500 lbs. All the experiments made within these limits agree in showing that the friction of surfaces moving on each other, is independent both of the velocity and the surface, and proportional to the pressure. Coulomb, it is true, had already inferred these laws, but he stated many exceptions to them, which, according to the present researches, do not exist. Coulomb supposed that in the case of oak moving over oak, the grain of the wood all running the same way and in the direction of the motion, the relation of friction to pressure was 11 per cent., while Mr. Morin found it to be 48 and 32. Mr. Morin found for elm running over oak 48, when the fibres are parallel, and 41 when they are perpendicular. He also rectifies the mistake of mechanics who believe the friction to be less between heterogenous substances than between those of the same kind, and

shows that the friction of metals on wood is greater than that of oak on oak; thus when iron is made to move over oak, the ratio is .61; and in the case of copper over the same wood, the ratio rises to .62. These interesting experiments, a report upon which is to be made to the academy by Messrs. Poisson, Arago, and Navier, will be continued by the author, who intends to obtain, if it be possible, the coefficient of friction for all the materials employed in the mechanic arts, in building, &c. [*Academy of Sciences*, 12 *Dec.*

Compensating Pendulums.

After the pendulum was applied as a regulator to clocks, and the other parts of these instruments had been rendered perfect in their construction, so great a regularity was obtained that the variations caused by the expansion and contraction of the rod of the pendulum, became sensible. M. Henry Robert, clockmaker at the palais royal, and pupil of Braguet, has lately communicated to the Society for the Encouragement of National Industry, a more simple method than that in use for obtaining an exact compensation in pendulums beating the half second. The common method of compensation is to make the rod of the half second pendulum of a single platinum tube, and the bob of zinc; the difference in the expansions of these two metals is such, that by exact calculations a perfect correction is obtained. Robert directed his attention to the pendulum with a wooden rod, for the purpose of using it in ornamental time pieces, for which the zinc and platinum pendulum (gridiron) was unsuited, from the comparative plainness of its appearance. By a simple and easy device he has so constructed it as to protect it completely from the action of the atmosphere, so that it may now be substituted for the best metallic compensators, in every kind of clock. In the construction of this new pendulum, M. R. profiting, on the one hand, by the well known property possessed by the wood of the fir tree, of preserving its length unaltered in all changes of temperature, has been enabled to confine his attention simply to its tendency to warp, by the absorption of moisture from the atmosphere, and to prevent this encloses the rod made of this wood in a metal box; the expansion of the bob corrects that of the tube.

This simple pendulum unites all the requisites of a good compensator, while at the same time it may be put together with ease; it takes up little room, is of a very simple form, and may be placed in the most beautiful models where the pendulum is exposed to view.

[*Ibid.*

Preservation of Wood.

A method of preserving building timber from decay has long been a desideratum. The attempts hitherto made, have not, however,

been attended with success. Timber for ship building is subject to a peculiar species of decay, called the *dry rot*, a method of preventing which would be exceedingly valuable. At the meeting of the Society for the Encouragement of National Industry, on the 21st December, Mr. Bréant, Assayer of the Mint, and an able chemist, exhibited several pieces of wood of many inches square, and several feet long, which had been prepared by him according to a new process, which is expected to preserve them from every species of decay. The details of the method have not been made public by M. B.; he has merely stated that the wood is soaked in saline solutions and in oily and resinous matters. These substances penetrate so completely throughout the mass of the wood, that when one of the blocks exhibited before the society was sawed in half in presence of the members, it was found to be thoroughly impregnated with them even to its very centre. M. B.'s process requires but two or three days for completion, even in blocks of wood of a large size. If further experience confirm what science has thus suggested, the difficult problem of the preservation of wood may be considered as solved. M. B. states that he will shortly be able to furnish timber of all sizes prepared in this way. [*Ibid.*

New method of determining the Strength of Bleaching Salts.

We have already described several processes of different degrees of exactness, for determining the strength of bleaching salts,* and now give another which, though not very accurate, is exceedingly simple, and may be executed by every one. If we pour into a graduated tube, one measure of common ink, and then add successively, proceeding by *fourths*, $\frac{1}{4}$, $\frac{2}{4}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$, &c. measures of water, we shall of course obtain inks more and more pale in the same proportion. Lines are to be drawn very near together on a sheet of paper, with the inks thus obtained; that is, for the sake of convenience, a line is to be drawn after each addition of the water, which method will readily give us lines growing regularly paler and paler in a fixed proportion. When this is done, we are to cut off with a punch, of the same size, small disks of the paper thus ruled, so that each disk shall contain lines of all the different strengths, from the deepest to the palest. If we now wish to determine comparatively the strength of a sample of chloride of lime (bleaching salts) we have only to take a small quantity of it, and wet it sufficiently to make a conical cake, the base of which must cover exactly one of the pieces of paper, upon which it must be suffered to stand for about five minutes. The number of lines effaced will then give the comparative strength of the chloride. As these trials are only comparative, we must always make use of the same ink; and a trial should have been previously made with paper ruled by it, and bleaching powder, the strength of which had been accurately determined by other methods; this previous trial furnishes

* See this Journal vol. ix. p. 211 and 337, vol. x. p. 181, &c.

us with our standard of comparison. In the case of bleaching liquors (as Labarraque's disinfecting soda liquid, or the chloride of soda, &c.) a given quantity must be poured into a graduated tube; the trial piece of paper is then to be introduced into the same, and there to remain for a determinate space of time, to be acted on by the liquid. While the action is going on, it is better to cover the piece of paper by a wine glass or tumbler. Some chloride of lime furnished by Mr. de Rezé, from the mines of de Vic, erased completely all the lines from a piece of paper, while the best chloride (of commerce) of Paris, destroyed only $\frac{25}{40}$ths of the lines of a piece of paper ruled with the same ink. [*Ibid.*

W.

Meteorological Observations for July, 1832.

Moon.	Days	Therm.		Barometer.		Dew point	Wind.		Water fallen in rain.	State of the weather, and Remarks.
		Sun rise	2 P.M.	Sun rise.	2 P.M.		Direction.	Force.		
				Inches	Inches.				Inches.	
	1	66°	72°	30.00	30.00	66	S.	Moderate.	.10	Drizzle—cloudy.
	2	65	86	.00	.00	65	SW.	do.	.30	Rain—flying clouds.
☽	3	62	84	.5	.5	65	W.	do.		Clear—rain in the night.
	4	71	86	29.90	29.90	75	W.	Calm.	1.50	Fog—lt. cl'ds. rain in n't.
	5	71	81	.85	.90	71	SE.	Moderate.	.2	Rain—flying clouds.
	6	67	83	.90	30.00	71	W.	do.	.52	Cl'dy; fly'g cl'ds; slight sh.
	7	73	85	30.00	29.90	73	SW.	do.		Fog; fly'g cl'ds. thund. sh.
	8	71	79	29.85	.80	74	SW.	do.	.95	Drizzle; flying cl'ds. rain.
	9	68	71	.70	.70	68	SW.	do.		Rain—flying clouds.
	10	68	76	.65	.70	63	W.	do.		Cloudy—flying clouds.
☺	11	60	79	30.00	30.05	59	W.	do.		Clear day.
	12	62	82	.10	.10	62	W.	do.		Fog—clear.
	13	68	85	.4	.4	67	SW.	Breeze.		Fog—clear.
	14	71	85	.00	.10	71	SW.	do.		Fog—clear.
	15	74	85	.00	29.90	73	SW.	do.		Cloudy—clear.
	16	71	83	29.80	.80	73	SE.	do.		Clear—showery.
	17	71	63	.80	.85	58	SW.	do.	1.35	Rain—cloudy.
	18	60	63	30.00	30.5	61	NE. SE	Blustering.		Cloudy day—rain.
☾	19	71	77	29.80	29.70	69	S.	Moderate.	.15	Drizzle—flying clouds.
	20	66	76	30.00	30.5	59	W.	do.		Clear day.
	21	61	76	.5	.5	62	SW.	do.		Clear—cloudy.
	22	63	76	29.84	29.80	68	S.	do.		Drizzle—flying clouds.
	23	65	79	.74	.74	61	W.	Breeze.		Clear day.
	24	59	79	.84	.90	55	W.	do.		Clear—light clouds.
⊗	25	52	67	30.10	30.10	38	NW.	do.		Clear day.
	26	50	70	.10	.10	47	W.	Calm.		Clear day—sun eclipsed.
	27	52	74	29.93	29.93	56	W.	do.		Clear day.
	28	60	76	.90	.90	61	SSE	do.		Cloudy day.
	29	68	80	.94	30.00	66	SE. W.	Breeze.	.1	Drizzle—clear.
	30	64	83	30.00	.00	69	SW.	do.		Fog—clear.
	31	70	86	29.94	29.80	73	W.	do.	.50	Fog—thunder shower.
	Mean	65.16	78.29	29.93	29.93	64.4			5.40	

	Thermometer.	Barometer.
Maximum height during the month,	86. on 2d, 4th & 31st.	30. 10 on 12th, 14th, 25th & 26th
Minimum do.	50. on 26th.	29.65 on 10th.
Mean do.	71.73	29.93

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

NOVEMBER, 1832.

On the arrangement of Safety Valves.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Blairsville, Sept. 21, 1832.

Sir,—Should the arrangement for safety valves suggested below afford a probable remedy for *old* defects, without liability to produce greater *new* ones, please give the following remarks a place in your Journal, and oblige

Your obedient servant,

D. Livermore.

The experiments on the adhesion of disk valves, by Messrs. Hopkins and Roberts, as given in the last number of the Journal, seem to afford a probable solution of the causes of defective action sometimes observable in the safety valves of steam engines.

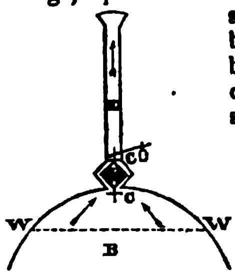
The reasoning of Mr. H. upon the subject, appears, however, more metaphysical than could be wished.

The experiments lead to the conclusion that adverse currents, or eddies, in the air discharged above the valve, contribute largely to produce the adhesive effects observed. The cause of these eddies may be traced to the enlargement of the discharging aperture immediately above the valve, giving room for sudden lateral expansion. This being likewise the case with safety valves of ordinary construction, we observe like defects in their operation.

It is, therefore, highly probable that valves so constructed as to give, when open, a uniform internal area for each cross section of the 'scape-pipe, would act with greater freedom and certainty. Suppose the valve conical both at top and bottom, or rather of such form

as to embrace two perfect cones connected at their bases, and the seat formed by an enlargement of the 'scape-pipe, so proportioned as to give the same capacity for discharge around the open valve as in other parts of the pipe. The lateral expansion above the valve would be sufficiently limited, and the lower formation such as to prevent counter currents from having a prejudicial effect by producing a vacuity under the valve, as observed in the experiments of Messrs. Hopkins and Roberts. To secure a vertical ascent and descent, pieces projecting from the vertices of the valve should pass through two cross bars. The upper bar serves likewise to limit the rise of the valve to the height required.

The enlargement of the 'scape-pipe should give room for the discharge, equivalent to the space occupied by the upper bar; but the same advantage can be obtained for the lower bar by placing it a little below the top of the boiler. The whole arrangement will be sufficiently obvious by reference to the annexed sketch.



E, 'scape-pipe.
V, valve (open.)
C, C, cross bars.
B, boiler.
W, W, water line.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

An abstract of the mode of Building in Pisé, or Earth Walls, with additional Suggestions, by J. D. Burr.

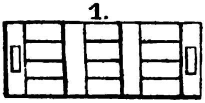
This method has been long practised with success, and very cheaply, in France and other parts of Europe. It is done by ramming moistened earth between planks or "mould boards," thus forming walls of cottages which, when dry, become firm, hard, and durable. Buildings are said to have been pulled down when nearly two centuries old, and that the walls were found still perfect.

In the first place, a preparatory brick, or stone, foundation must be built, to rise eighteen inches above the level of the ground, and of the thickness of the earth wall, which is usually eighteen inches at bottom, and reduced, or battered, to fifteen at top. This foundation is to preserve the wall from the effects of the splashing of rain.

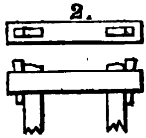
The walls are formed by ramming earth of suitable quality (as hereafter described) between mould boards, which should be ten feet in length, and about two and a half feet wide, which are made like batton doors, and with four battons each from nine to twelve inches wide, two of them at the end, and two dividing equally the intermediate space; the boards should be of pine at least inch thick, strongly made, and tongued, and grooved, and planed smooth inside, and of equal thickness; on the end battons should be fixed strong cleats to serve

for handles, (fig. 1:) only two of these mould boards are required. They are placed on each side of the foundation wall, beginning at one corner, and the outside mould is projected beyond the corner, while one end of the other mould is made to fit the inside of the corner, thus to support the earth that is to be rammed between the moulds.* The moulds are to lap on the foundation wall at least one or two inches, and they are secured in that position at bottom by two pieces of scantling (for which recesses must be left, or cut, in the foundation,) dressed smooth and true, three feet long, five inches wide, and three thick, with mortises at each end to receive strong tenons of upright braces and wedges to secure them in their proper distances, (fig. 2;) four upright braces in their tenons extending a foot or more above the mould board, are secured at top by ropes passing around each two opposite braces which are drawn and secured to their proper position by twisting the rope with a stick in the same manner as a wood saw frame is braced. Two gauges, (fig. 3,) of the length to regulate the slope and thickness of the wall at the top of the mould, are there inserted between, or by the sides of, the braces, (fig. 4.)

1.



2.



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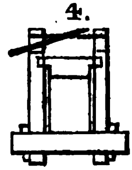
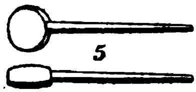


The earth used for these walls must be a strong loam, of such properties that on being rammed hard when slightly moist, it will become firm when dry; this must be ascertained by experiment, i. e. by ramming the earth in any small box, or vessel, strong enough to resist the pressure, and letting it remain till dry, when it will be nearly as hard and solid as brick. Most stiff soils are considered good for this purpose; a light or sandy loam may be made suitable by mixing with it from one-eighth to one-fourth of clay. The earth should be well pulverized, and thrown up in ridges so that the lumps will roll down and be broken. The proper degree of moisture may be obtained by adding to any quantity of quite dry earth from one-half to one-eighth of its weight of water, in such manner as to thoroughly incorporate it.

To make the wall, only so much earth must be put between the moulds at once as will form a layer of three or four inches deep, which is to be rammed hard with a rammer of hard wood, the head of which is directed to be made circular, and swelling to the middle,

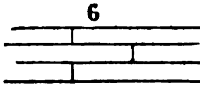
* It appears to me that it would be much better to have two pair of moulds, and to fit them up to each corner, embracing both sides in succession, which would form the corner more easily and completely, and more hands could in this manner be employed in ramming up. J. D. B.



5

(fig. 5,*) and into this a suitable handle is inserted. The first strokes of the rammer should be made close to the side and then applied to every part of the surface. Several workmen may be employed in ramming one mould, each ramming his own division, and then crossing the stroke under the rope, so that the earth will be pressed in every direction: care must be taken that no fresh earth is received into the moulds until the first layer is thoroughly rammed, which is ascertained when the stroke of the rammer leaves hardly any print. Proceed in this manner till the mould is full, the braces are then slackened, the bottom piece drawn out, and the mould and frame removed to the next corner, when proceed as before. Observe, however, in placing the moulds, so to arrange or vary them, in opposite directions in each succeeding corner, that the joinings near the middle of each side of the wall shall not be perpendicular, but vary a foot or more in each layer, (fig. 6.) The joinings will not then be perceptible, and the wall will be rendered stronger. The holes left by the bottom pieces of the frame are to be filled up, and rammed when the wall is up.

6



Of the proper kinds of earth.—It is stated that, 1st, all earths in general are fit for use when they have not the lightness of poor land, nor the stiffness of clay. 2nd, all earths fit for vegetation. 3d, strong earths mixed with small gravel, with which the best work is done. Experience proves that so soon as the wall is made, the heaviest beams and rafters may be placed on them without danger. The gable end may also be made of earth wall.†

The door and window frames must be set in as the work progresses, they are made of one and a half or two inch plank, of a width to correspond with the thickness of the wall: the rebates and grooves for the doors, window sashes, and shutters, can be formed in the frames when made, or it may be done by mouldings after the walls are built. Strips of plank must be nailed all around on the outside of the frames to secure them firm in the wall. To bind the walls more strongly, at about every two feet of rise, strips of plank, split sticks, or laths, six or eight feet long, are laid lengthwise, but not nearer to the outside of the wall than two inches, that they may be hid; between these is a layer of the same material, eight or nine inches long, and laid across the wall for the same purposes. Walls built in this manner, of proper earth, are so substantial that the plates, rafters, and roofs, of the heaviest kind, may be immediately put on without danger.‡

* The form of the rammer is said to be very important; this I doubt. The weight, I believe, is not stated. I think the rammers used in iron foundries would answer perfectly well, viz. a flat iron head of about three pounds weight, to ram close to the moulds in the first place, and then a round iron head of about six pounds, to go over the whole.

† I apprehend it would be adviseable, until experience is gained, for them to be made with studs, and weather-boarded, in the usual way.

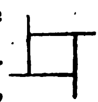
‡ Floors made by ramming earth in the same manner and raised about a foot

Remarks on the foregoing plan of Building Earth Walls for Cottages. By J. D. B.

Its adoption will be a great saving in rural economy where lumber and bricks are dear, or cannot be had; and would be preferable to log cabins in new settlements; such, however, is the force of habit that it will not supersede them; but I have made the above extracts with a view specially to the Liberian Colony, where the timber is not suitable for plank, and lumber for building is mostly imported, and is, of course, very expensive, and stone, or brick walls, equally or more so; and it is of great importance that new settlers, especially farmers, should be cheaply, readily, and comfortably accommodated. These benefits are all united in this plan. It is believed that half a dozen men would, after due preparations, ram up the walls of a cottage eighteen feet square, in two days; and as the natives are already versed in building huts of clay, the change will not be so great to them, but that they might be employed in this mode of building, and probably they would adopt it, as one of the earliest steps toward their civilization.

The only difficulty I apprehend in the execution of the work is, in so adjusting the moulds when drawn up, as to form and preserve the walls truly perpendicular, and with the intended *batter*, or taper. This will require as correct workmanship as in laying a brick wall. To obviate this difficulty, and put the business within the ability of common workmen, I will propose as a substitute for the moulding board a method that has occurred to me as simple and requiring very little skill, and which may, perhaps, be in other respects preferable—it is this:

The foundation being built, as above directed, of stone or brick, plant posts strongly in the ground on both sides of the foundation, three or four feet apart, in the direction of the walls, and higher than they are to rise. These posts must be in opposite pairs, stiff, and dressed straight on the inner sides, allowing as much space on each side of the foundation as merely to admit the plank, or board, used in the construction, by this mode, to be slipped, or driven, into the spaces. These boards may be of common inch, or inch and quarter, pine, but all used on any one side must be of equal thickness, and all with straight and fair edges and ends. They are to be placed inside of the posts, edge upon edge, as the wall is rammed up, one above another from bottom to top. The plank forming the interior must be cut of lengths to reach exactly from corner, on the outside their ends may project thus—



The posts are secured at top to allow just the space for the thickness of the wall, and of the planks on each side, by tenons made on the posts, over which braces, or gauges, with

above the level, will doubtless be dry, comfortable, and as healthy as brick pavement.

When the walls have become dry, which will require several months, they may be whitewashed with lime, or rough-cast in the usual way, and will then appear as handsome as any stuccoed wall.

mortices, are placed and secured by wedges on the outer sides. When the wall is made, the wedges being driven out, the gauges, planks, and posts, may be successively removed, and the wall is completed. The only difficulty I anticipate in this process, will be in planting the posts exactly in true lines. This, however, I think may be effected by first planting the posts nearest to each corner in correct positions; then fixing the braces on them at top and dropping upon them thick plank of such width as to fill up the space between the posts, which plank will then regulate the tops of all the posts that remain to be set up.

For a single building this plan might be more expensive than the first described, but where a number of houses are to be built, as the same posts and boards will answer for all of them, I believe it would be cheapest, easiest, and certainly best, where good mechanics are wanting.

In putting on the roof it will be prudent to give the eaves a bold projection, to secure the walls from the effects of rain, and also to put a weather, or wash, board in a sloping position, across the ends of the house (from eve to eve,) for the same purpose.

Nothing yet has been said in regard to chimnies. I presume when brick work is easily procured, it may be best to build the chimney therewith when the foundation is laid; but in Liberia, if wanted at all, the fire-place may be built of brick or stone, and the chimney be formed of clay like the native huts, and outside of the wall; similar to the plan pursued with log houses in this country.

FRANKLIN INSTITUTE.

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, *to ascertain, by experiment, the value of Water as a Moving Power.*

(Continued from p. 16.)

WHEEL No. IV.

This wheel, six feet in diameter, was substituted for No. III. The barreling of the shaft was removed, and the chain, which supported the weights raised, wound directly upon the axis. The iron basket, used in former experiments to contain the weights, was also removed, and the weights were applied directly, by hooks, to the chain.

To ascertain the amount of friction at the gudgeons of the wheel, a cord was wound around the axle, and weights applied until a uniform velocity, of six feet per second, was maintained in the periphery of the wheel, by the descent of the weights. The weight of the wheel was twelve hundred pounds, and seventeen and four-tenths pounds maintained a velocity of six feet per second. The friction was therefore nearly one and a half per cent, (1.45) of the weight. One per cent of the weight applied was, as before, the ratio of friction upon the gudgeons of the drum.

The rate of friction being different in the wheel and drum, the calculations relating to it are less conveniently made than in the former cases. The principle upon which they are made is, however, still simple and obvious. When any weight is applied to the chain and raised by the wheel, the gudgeons of the drum support the tension of both the parts of the chain, viz. that between the drum and the weight, and that between the drum and the wheel; the pressure upon the axis of the drum is therefore twice the weight raised. The rate of friction upon this is one per cent.

The tension of the part of the chain between the drum and wheel, the chain being very nearly vertical, relieves the gudgeons of the wheel of a weight equivalent to that tension; that is, to the weight applied to the other end of the chain. The friction upon this weight, at one and a half per cent., is therefore to be deducted from the friction due to the weight of the wheel.

The following calculations are made in accordance with the principles just stated.

Constant *inactive* weight.			
Weight of the wheel, - -	1200 lbs.		
Friction given by experiment, -			17.40 lbs.
Average weight of the chain wound around the axle of the water wheel, - -	80 „		
Friction at one and a half per cent., -			1.20 „
Weight of the drum, -	200 „		
Friction at one per cent. - -			2.00 „
Weight of the chain borne by the gudgeons of the drum, - - -	184 „		
Friction at one per cent., - -			1.84 „
Friction due to constant *inactive* weight, -			22.44 lbs.
Constant *resisting* weight.			
Weight of the chain between the shaft and the ground, - - -	20 lbs.		
One piece of lead, - -	9 „		
Sum, - - -	29 lbs.		
Pressure upon the gudgeons of the drum due to 29 lbs., - -	58 lbs.		
Friction at one per cent., -		.58 lb.	
Gudgeons of the wheel relieved from,	29 „		
Friction at one and a half per cent., -		.43 „	
Difference, - - -		.15 lb.	
Friction, carried out, - - -			.15 lb.

The centre of gravity of the wheel when loaded was 1.75 feet from the axis, the chain was .5 ft. from the same axis; hence to raise 29 lbs. and overcome a friction of (22.44 +

.15) 22.59 lbs. required a weight of water of 14.74 lbs. The friction upon this at one and a half per cent. is - - - -	.22 lb.
Total friction when a weight of 29 lbs. was raised, - - - -	22.81 lbs.

To determine the friction due to a weight added, as, for example, to 56 lbs. we have—

Pressure upon gudgeons of drum, -	112 lbs.	
Friction at one per cent., - -		1.12 lb.
Gudgeons of wheel relieved from -	56 ,,	
Friction at one and a half per cent. -		.84 ,,
Difference, - - - - -		.28 lb.
To balance 56 lbs. and overcome a friction of .28 lb. required, of water, 16.08 lbs. The friction upon this at one and a half per cent. is - - - -		.24 lb.
Total friction for 56 lbs. additional weight,		.52 lb.

The details in relation to wheel No. IV, are as follow:

The diameter of the wheel six feet; the breadth twenty inches, or sixteen inches between the cants; cants six inches deep.

Advantage was taken of the very manageable size of this wheel to experiment upon various forms of buckets. The varieties are figured on Plate VIII, figures 1, 2, 3, 4, 5. Fig. 1 shows the form and dimensions of the first variety of elbow buckets: in these the width of the elbow was three inches, and the opening at the throat two inches; the number of buckets twenty. Fig. 2 represents the second variety of elbow buckets; the width of elbow, as before, three inches, and opening of the throat two inches, the number of buckets forty. Fig. 3 gives the form of the oblique buckets next affixed to the wheel; the face of each bucket made an angle of thirty degrees with the tangent to the wheel at the point at which the bucket was placed; they differ, therefore, from the oblique buckets which were used with wheel No. I. There were thirty of these buckets around the wheel. Figs. 4 and 5 show the two forms of curved buckets which were made the subjects of experiment. The lines upon which the curved buckets of fig. 4 were traced (see *a b* fig. 4, Plate VIII.) made angles of twelve degrees with the tangents at the several points at which the buckets were placed, thus representing very oblique buckets; on these lines the buckets were traced by the following method, which is given for a single bucket. The width of throat being fixed at two inches, a circular arc was traced through *a*, tangent to a circle of two inches and a half radius, and described with the centre *b;* thus the proper width of throat, allowing for the thickness of the boards forming the buckets, was secured; to this circular arc a line *d e*, being drawn tangent, completed the form of the bucket.

After the buckets just described had been made the subjects of ex-

periment, the straight line part was cut away until the throat was widened to three and one-eighth inches, giving the bucket shown in fig. 5. In this case a more easy escape was provided for the air, and, of course, a more free access permitted to the water.

It was not deemed necessary to add to the already prolonged labours of the committee, by repeating the excellent experiments of Poncelet on the application of curved buckets to undershot wheels.

This wheel was used only as an overshot wheel; the breast, when used, extended to the level of the centre of the wheel. The gate generally used in the experiments with this wheel is shown in fig. 1 of Plate VIII, in which *a* is the chute, and *b* the sliding gate, which in the figure is closed; by drawing this gate to the right, the chute was opened, and the water delivered between the projection *c* and the side *d* of the chute.

To ascertain the relative effect of water when issuing under a head upon the wheel, and when taken from the surface, by being allowed to flow over a gate, the form of gate given in fig. 6, Plate VIII. was used. An opening, *a b*, was made in the bottom of the forebay, to one side of which the hinged gate *c* was attached, the hinge being at *a;* the gate was moved by the stem *d.* When the face was vertical, as shown by the full lines in the figure, the gate prevented the water from passing to the wheel; when inclined, as shown by the dotted lines, the water, which was kept at a constant level in the forebay, flowed over the surface of the gate and fell upon the wheel. In using this gate the direction of the motion of the wheel was reversed, and there was no breast.

The experiments made with wheel No. IV. will be given in five tables. Table 1, parts I and II, will contain the results of trial with the forty elbow buckets (fig. 2, plate VIII;) table 2, parts I, II and III, those with the twenty elbow buckets, (fig. 1, Plate VIII;) table 3, parts I, II and III, those with the thirty oblique buckets, (fig. 3, Plate VIII;) and table 4, those with the curved buckets of fig. 4 Plate VIII; and table 5, those with the curved buckets of fig. 5, of the same plate. The experiments with the gate of fig. 6, Plate VIII, were made with the curved buckets of fig. 5, and are included in the table 5 with those made with the same buckets and the gate of fig. 1.

The tables now to be given complete those containing the record of the experimental researches of the committee in relation to water wheels. Circumstances prevented the committee from taking up the subject of the reaction wheel, to which they alluded in the commencement of this report.

Table 1.—Part I.

Wheel No. IV. 40 Elbow buckets. Close breast. Water let on at upper centre of wheel.

No. of Exper't.	Head of water above. Bun. of gate.	Top of bkt.	Bun. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt. of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	0.25	0.50	1.00	0.50	29	22.81	51.81	40.0	36½	5.94	350	6.50	22750	20724	.911	.911	5.94	
2					43	22.94	65.94		49	4.43	470		30550	26376	.863			
3					57	23.07	80.07		55	3.93	585		38025	32028	.842			
4					71	23.20	94.20		73	2.97	720		46800	37680	.805			
5				1.00	43	22.94	65.94		29½	7.35	500		32500	26376	.812			
6					57	23 07	80.07		35	6.20	600		39000	32028	.821			
7					71	23.20	94.20		41	5.29	680		44200	37680	.852	.852	5.29	
8					85	23.33	108.33		48½	4.47	815		52975	43332	.818			
9					99	23.46	122.46		57	3.80	930		60450	48984	.810			
10				1.25	57	23.07	80.07		30½	7.11	630		40950	32028	.782			
11					71	23.20	94.20		36½	5.94	720		46800	37680	.805			
12					85	23.33	108.33		41½	5.22	800		52000	43332	.833	.833	5.22	
13					99	23.46	122.46		47	4.61	920		59800	48984	.819			
14					113	23.59	136.59		49	4.43	1035		67275	54636	.812			
15					127	23.72	150.72		59	3.67	1145		74425	60288	.810			
16				1.50	85	23.33	108.33		34½	6.29	835		54275	43332	.798	.798	6.29	
17					99	23.46	122.46		39½	5.49	950		61750	48984	.793			
18					113	23.59	136.59		46½	4.67	1080		70200	54636	.778			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table 1.—Part II.

Wheel No. IV.—40 *Elbow buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate. Feet.	Head of water above. Top of bkt. Feet.	Head of water above. Btm. of bkt. Feet.	Width of aperture. In.	Weight raised. Pds.	Friction. Pounds	Sum of friction and weight raised. Pounds.	Height raised. Feet.	Time. Scds.	Velocity per second. Feet.	Wt of water expended. Pds.	Head and fall. Feet.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
19	0.25	0.50	1.00	1.75	85	23.33	108.33	40.0	31½	7.11	955	6.50	62075	43332	.698			
20					99	23.46	122.46		38½	5.64	1075		69875	48984	.701			
21					113	23.59	136.59		39½	5.49	1150		74750	54636	.731	.731	5.49	
22					127	23.72	150.72		46	4.71	1280		83200	60288	.724			
23					146	23.90	169.90		51½	4.23	1355		88075	60288	.684			
24	0.75	1.00	1.50	0.38	85	23.33	108.33	40.0	34½	6.29	795	7.00	55650	43332	.779			
25					99	23.46	122.46		43	5.03	880		61600	48984	.795	.795	5.03	
26					113	23.59	136.59		45½	4.75	995		69650	54636	.784			
27				0.75	113	23.59	136.59		39	5.57	975		68250	54636	.801	.801	5.57	
28					127	23.72	150.72		45½	4.75	1085		75950	60288	.794			
29					138	23.83	161.83		51	4.29	1175		82250	64728	.787			
30				1.00	138	23.83	161.83		35	6.20	1255		87850	64728	.737			
31					146	23.90	169.90		36	6.03	1320		92400	67960	.735			
32					160	24.03	184.03		38½	5.64	1400		98000	73612	.751			
33					174	24.16	198.16		40½	5.35	1600		105000	79264	.755	.755	5.35	
34				1.25	174	24.16	198.16		41½	5.22	1525		106750	79264	.743			
35					184	24.25	208.25		39½	5.49	1590		111300	83300	.748	.748	5.49	
36					198	24.39	222.39		40½	5.35	1705		119350	88956	.746			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE 2.—PART I.

WHEEL No. IV.—20 *Elbow buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	0.25	0.50	1.00	0.50	30	22.82	52.82	40.0	37	5.86	375	6.50	24375	21128	.867	.867	5.86	
2					41	22.92	63.92		49	4.43	465		30225	25568	.846			
3					44	22.95	66.95		49	4.43	490		31850	26780	.841			
4					58	23.08	81.08		62	3.50	605		39325	32432	.825			
5				0.75	44	22.95	66.95		37½	5.78	500		32500	26780	.824	.824	5.78	
6					58	23.08	81.08		46½	4.67	615		39975	32432	.811			
7					72	23.21	95.21		57	3.80	730		47450	38084	.803			
8				1.00	44	22.95	66.95		33	6.57	555		36075	26780	.742			
9					58	23.08	81.08		38	5.71	665		43225	32432	.750	.750	5.71	
10					72	23.21	95.21		46	4.71	805		52325	38084	.728			
11					86	23.34	109.34		59½	3.64	950		61750	43736	.708			
12				1.50	58	23.08	81.08		30½	7.11	740		48100	32432	.674			
13					72	23.21	95.21		33	6.57	800		52000	38084	.732			
14					86	23.34	109.34		38	5.71	910		59150	43736	.739	.739	5.71	
15					100	23.47	123.47		44	4.90	1040		67600	49388	.731			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE 2.—PART II.

WHEEL No. IV.—20 *Elbow buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of Water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
16	0.75	1.00	1.50	0.38	44	22.95	66.95	40.0	31½	6.89	470	7.00	32900	26780	.814			
17					58	23.08	81.08		36½	5.94	550		38500	32432	.842	.842	5.94	
18					72	23.21	95.21		43½	4.96	675		47250	38084	.806			
19				0.50	58	23.08	81.08		32½	6.67	585		40950	32432	.792			
20					72	23.21	95.21		37	5.86	680		47600	38084	.800	.800	5.86	
21					86	23.34	109.34		43½	4.96	800		56000	43736	.781			
22					100	23.47	123.47		54	4.00	925		64750	49388	.763			
23					114	23.60	137.60		58	3.74	1045		73150	55040	.752			
24					133	23.78	156.78		55	3.93	1245		87150	62712	.720			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table 2.—Part III.

Wheel No. IV.—20 *Elbow buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
25	2.75	3.00	3.50	0.17	58	23.08	81.08	40.0	25⅓	8.51	645	9.00	58050	32432	.559			
26					72	23.21	95.21		27	8.03	665		59850	38084	.636			
27					86	23.34	109.34		30½	7.11	730		65700	43736	.665	.665	7.11	
28					100	23.47	123.47		35	6.20	825		74250	49388	.665			
29					114	23.60	137.60		37	5.86	930		83700	55040	.657			
30					128	23.78	151.73		37½	5.78	1045		94050	60692	.645			
31				0.25	58	23.08	81.08		22	9.86	925		83250	32432	.390			
32					86	23.34	109.34		24	9.04	1005		90450	43736	.484			
33					114	23.60	137.60		26	8.34	1105		99450	55040	.553			
34					161	24.04	185.04		30½	7.11	1335		120150	74016	.616			
35					189	24.30	213.30		35	6.20	1520		136800	85320	.624	.624	6.20	
36					217	24.56	241.56		38½	5.64	1730		155700	96624	.620			
37					231	24.69	255.69		42½	5.09	1830		164700	102276	.620			
38	3.75	4.00	4.50	0.12	58	23.08	81.08	40.0	25⅓	8.51	600	10.00	60000	32432	.540			
39					72	23.21	95.21		30	7.23	630		63000	38084	.604	.604	7.23	
40					100	23.47	123.47		40	5.42	845		84500	49388	.584			
41					114	23.60	137.60		42	5.16	960		96000	55040	.573			
42					133	23.78	156.78		45⅓	4.75	1100		110000	627120	.570			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

[TO BE CONTINUED.]

Analysis of the Report, &c. on Steam Carriages.

Report on Steam Carriages by a Committee of the House of Commons of Great Britain. With the minutes of Evidence, and Appendix. Reprinted by order of the House of Representatives of the United States. (1832.)

(Continued from p. 273.)

"You have stated that you think the bringing of these machines to perfection is retarded, because there is not a sufficient prospect of encouragement, and that steam coaches are therefore confined to the hands of persons who have not the same skill in practical mechanics as others, who would undertake the subject if adequate encouragement were offered; can you point out any mode by which that encouragement could be given? Nothing could do it so effectually as offering a handsome parliamentary reward for the attainment of some specified performance, such as keeping a steam coach for passengers regularly plying on some suitable road for two years, during which it should not have failed to arrive by steam more than some specified number of times, and within a certain number of hours of lost time from the time-bill of the mail on the same road. Suppose this were done between London and Bristol, for a reward of £10,000, it would cost the public nothing if it were not accomplished, and the establishment of that one coach to carry the mail would be worth the money to the public whenever it was accomplished: or between London and Holyhead would be still more important, but that would require £20,000 reward. Another plan of more immediate application would be to offer a bounty of a fair price per mile for carrying despatches by steam (as I suggested before) whenever they arrive in a specified time; the price should be sufficient to pay expenses. That would, I think, be the best course, because I believe it would be undertaken at once by individuals, provided that no stipulations were made either for or against carrying passengers or goods. They would be sure to carry passengers and goods as soon as they could, for their own profit; and it might be stipulated, that after any coach had earned a certain sum in bounty, it should not be entitled to more. The effect of such public rewards has been very striking in the case of the invention of means of ascertaining the longitude at sea. Another way would be, instead of money, to give exclusive privileges for a term to any persons who should first succeed in establishing steam coaches on specified roads, under specified conditions of performance; or a society offering a premium, as was done in the case of steam navigation to India, would have a good effect: as was also shown in the case of the locomotive steam carriages on the rail-way between Liverpool and Manchester. There a most inadequate premium (only £500,) brought the invention forward more than ten following years of desultory and unencouraged attempts would have done."

"You think those means would produce a great effect? I have no doubt of it; an important result may often be within a moderate sum of attainment, and yet a prudent man will not set about it. It will be certain to cost £1,000 and a year's hard labour of an engineer, whose time is worth £500 more, to make a new steam carriage in a proper manner and bring it to bear as a business, supposing that its performance turns out as near to previous calculation, according to the experimental coaches now in existence, as can be expected, and that no radical alterations require to be afterwards made in it. After succeeding in the attempt, he must expect to make copies of it on the same terms as other makers, who would examine one of the first coaches he sends out, and copy it with very little trouble. The operations of competent mechanicians in making first machines of new invention, and bringing them to perfection in all their details, are necessarily more expensive than those of first inventors, who execute their experimental machines in a slovenly manner with cheap workmanship only as

experiments; but when those experiments have been gone through, an extreme soundness and accuracy of workmanship is the only chance of attaining success in the machines which are sent out for real business. For want of experience to direct the mechanician as to the right form, dimensions, and weight, of each piece of his machine, it often happens that, after having made a piece of expensive work, it will prove too slight or too heavy when set to work, and he may have to make it over again as expensively. The copyists who will afterwards come into competition with him when his machine is brought to bear, will have no such difficulties."

"You conceive that a grant of public money as a premium would call forth the necessary degree of skill? I have no doubt of it; we have had very few instances of invention being stimulated by the offer of public reward; but the instances, ascertaining the longitude is a most brilliant example. The facility and accuracy with which the longitude is now determined at sea, is the result of one of the greatest efforts of human genius and perseverance. The stimulus of reward has occasioned both modes of it to be perfected, viz. by astronomical observations and by time-keepers. We should very soon have steam carriages brought into full use if such a reward were offered."

"Have you ever ascertained the duty or performance of work done in respect to the fuel consumed by locomotive engines? They vary so greatly, that it is difficult to make a statement. The common locomotive engines which have been used for several years to draw coal wagons on rail-ways, have remained without material improvement for a long time, and their performance is very low, being only equal to raising about four millions pounds weight one foot high by the consumption of a bushel of coals, their boilers evaporating about four cubic feet and a half of water into steam with each bushel of coals. Such engines exert six to eight horse power. Mr. Stephenson's new quick-going engines on the Liverpool and Manchester rail-way are more improved in duty, and are in a progressive course of improvement; but as they burn coke instead of coal, the established mode of computation is inapplicable. Mr. Stephenson's small engine, called the Rocket, which gained the prize of £500, offered by the Liverpool and Manchester rail-way company, and which was the model for succeeding engines, exerted about six horse power during that trial, and burned 177 lbs. of coke per hour, which is at the rate of about five millions and a half pounds weight, raised one foot high by the consumption of eighty-four pounds of coal; but they have greatly reduced the consumption of fuel in the succeeding engines on that rail-way, owing to enclosing the cylinders of the engines within the lower part of the chimney, were they kept very hot, and an increased effect has been given to the fire by blowing the waste steam upwards through the chimney, as I stated before. In the Rocket they were just beginning to be aware of the value of that expedient for animating the fire, and it was done in a degree, but it has been since done more completely."

"Do you know how near any part of the rail-road between Manchester and Liverpool runs to the common road?—I cannot say; in passing along the railway, I do not recollect seeing the turnpike road, except crossing it several times."

"The noise made by the engines used on the rail-way is much greater than by the steam coaches, is it not? Yes; Mr. Hancock's coach makes less noise than any of Mr. Stephenson's engines; but the power exerted by the latter is much greater than by Mr. Hancock's engines. The quick travelling carriages on the Manchester and Liverpool rail-way, when drawn by the last improved engines, are extremely easy in their motion."

"Is it your opinion that a road would suffer less injury from the fore and hind wheels of a steam carriage following each other, in the same tracks on the road, than if they run on different tracks? That depends upon what kind of action the wheels exert on the road; if they cut it up and disturb the materials, by pressing down some stones so deep as to displace other stones sideways, and

cause them to rise up at the sides of the track, then it is best not to allow such wheels to cut the road twice in the same places; but if the fore wheels roll the road smooth on the surface, and consolidate, without disturbing, the materials; that is, if they only press down the stones over which they pass as much as will produce a close contact, but not so much as to displace the neighbouring stones laterally, then I think the hinder wheels should follow in the tracks of the fore wheels; certainly that is best for the carriage; and I believe it will be found that it makes but little difference to a good hard road whether the four wheels of a carriage follow in the same track or not, provided that the wheels are not loaded so as to indent deeply into the solid materials of the road. All carriages ought to have their wheels of such a breadth that they will not leave any material indentations in the road. They should rather consolidate the materials than break them up. If the fore wheels are only so much loaded, in proportion to their breadth and to the hardness of the road materials, that they will consolidate the materials over which they have passed, then I think it is quite as well for the road, and much easier for the carriage, that the hind wheels should follow in the tracks of the fore wheels. The loading of the carriage may be so arranged that the principal weight will be borne on the hind wheels, and the fore wheels may (by a suitable apportionment of breadth) be qualified to consolidate the road in their tracks, and thus prepare the way for the passage of the hind wheels, with the least wear of the road and the greatest ease to the carriage. It is quite as much the interest of the proprietors of carriages, as of the road trusts, that the roads should not be cut up by too narrow wheels, for it is always at the expense of horse labour that the road is thus injured, independently of the evil of having a worse road to travel over the next time. If the wheels are too narrow for the load upon them, and the road materials soft, so that the wheels do print tracks in the road, that evil will be greater, if the hind wheels follow the fore wheels than if they run in new paths; but it is better to remove the evil, by using broader wheels or less load, or harder road materials, and to run the wheels in the same tracks; because the resistance to a carriage is, in all cases, increased by running the wheels in different tracks, and that with little or no benefit to the road; particularly when the road is covered with mud and wet dirt, or snow. The above observations apply to all four wheeled carriages, whether they are drawn by horses or impelled by steam; but, in common carriages, the horses' feet tend to dig up the road. I think the steam carriages will, when perfected, be free from that objection, and that they have a greater claim to be allowed to run their wheels in the same tracks than other carriages.

"Were you ever in Mr. Hancock's carriage when travelling? Yes; I have ridden on it; but he has put in larger cylinders since I went with him the last time, and I understand makes better progress now. I have examined all his present machinery in detail, and think it very judiciously planned."

"Did you find that it frightened horses, or annoyed passengers? I have stated before, that I found horses were not frightened; but every one must judge for himself of the degree of annoyance he experiences. Persons who are accustomed to travel in luxurious private carriages, would find many annoyances in a common stage coach, which others would consider as excellent travelling. I am so accustomed to machinery, and to stage coach travelling, and to steamboats, that I am not liable to be annoyed thereby; and I found riding in Mr. Hancock's carriage to be exceedingly like travelling in a stage coach. I heard no complaints by passengers. I believe he has never found any difficulty in getting passengers, since he has run for hire. Persons are reported to be annoyed by the smell of hot grease, in the steam coaches on the Cheltenham road; I can only say, that I never observed such a smell in Mr. Hancock's carriage. If there are any real annoyances to the passengers in particular steam coaches, they will work their own cure in a short time, either by the proprietors finding out remedies, or else giving up their coaches, as they must do if they are not rendered agreeable to the passengers. The only question that

deserves attention is, whether there is any danger to passengers, or any serious annoyance to other persons not passengers."

"Did you observe any horses or carriages passing his carriage? Yes, I have always passed through crowds of horses and carriages with all the steam coaches I have tried; there is so much curiosity excited by the novelty of a steam coach in motion, that all the horses on the road are drawn up to get a sight of it, and many are turned to follow after it. I have observed that some horses take very little notice of the steam coach; others are a little startled, but I never saw any difficulty which the reins could not control with the greatest ease. Horses are easily alarmed at any thing unusual, but they very soon become accustomed to any thing, as is shown by the readiness with which horses can be brought to endure discharges of fire arms and of artillery. A patent was taken out some years ago for what was called a travelling Advertiser; it was a small four wheeled carriage, supporting an enormous octagonal tower, which was stuck all over the outside with printed bills for advertisements. It was drawn very slowly through the streets by one horse, and had a most unusual appearance: this machine was indicted as a nuisance because it frightened horses."

"Have you never observed horses to shy at a stage coach when heavily laden? I have observed horses to be alarmed at the enormous bulk which some of the vans carry at times at a great height above the ground. Horses are the most timid animals to encounter every thing that they are not accustomed to, and the most courageous animals to encounter every thing that they are accustomed to, even when really terrific, such as discharges of fire arms."

"Had you occasion to turn any sharp corners when in Mr. Hancock's carriage? Yes, many; the yard of his premises is exceedingly narrow and inconvenient to turn into and out from, but it is done with ease by the steam coach; the same place would not do at all for a coach and four horses to put up at."

"Going at what speed can you turn round a sharp corner without any danger? I do not remember turning with any considerable speed, nor should it ever be attempted with any carriage if it can be avoided, and there can be no necessity or pretence for going quick when turning a steam coach, as its power is quite controllable, in which respect it has a great advantage over a common carriage; for four horses at the moment of turning, are very little under the control of the reins, particularly the leaders, and it depends upon their good will whether they choose to go slow or go quick when turning. In a steam carriage, the conductor has such a perfect control of the power, that he can never fail in checking the speed at the moment of turning. I observed that Mr. Hancock's carriage is steered with the greatest ease, and will turn round in a very short space: I have seen him turn round in the new road to return without backing the carriage at all, although he was in the middle of the road when he began to turn."

"If you had turned a sharp corner, could you have stopped immediately on meeting a carriage? Yes; the power of stoppage is most remarkable: that is one of the great advantages of a steam coach. I have steered Mr. Hancock's carriage myself, and found it to be most completely under control."

"The carriage may be turned in the smallest space that the wheels will permit it to go round in? Yes, in a much smaller space than a carriage with horses can turn, because it is so much shorter in the total length, and the power being completely under control, there is no danger in turning quite short; whereas no prudent driver will turn a four horse coach round in a road, without the guard getting down and holding the leaders' heads; for they are not sufficiently under the control of the reins in turning to do it with safety."

"Did you ever see a steam carriage going down a hill? Yes, down the hill of the new road at Islington; and it was done with more safety than with any carriage with four horses; but I do not contemplate the descent of steam coaches down very steep hills, for that supposes their getting up such hills, which is not likely to be accomplished soon, and the present coaches seem to me to be only

fit for our most improved lines of roads, where all very steep hills have been reduced to moderate slopes.

"Have you turned your attention particularly to the subject of going up steep hills, and what ascent do you think can be surmounted? In forming my opinion of the probability that steam carriages will be brought to bear, I could not overlook the circumstance that they would have to go up and down hills; but most of our great lines of roads are now so improved, that what were formerly called steep hills are not very numerous or frequent; but wherever they do occur, I propose to give the steam coach the assistance of a pair of post horses in aid of its own power. In going down hill, steam coaches are very safe, because the whole power can be effectually exerted to retard or resist the turning of the wheels."

"Mr. Gurney's steam coach has gone up Highgate hill without horses? Yes, but I understood that it was broken in pieces in coming down again. My objection to attempting to make a steam coach go up a steep hill, in the present state of our knowledge, is, that it requires to have a great strength, and consequent weight of machinery to have a sufficient power to do so with safety, and which weight is a useless incumbrance and impediment to progression at all other times. The question is, whether all the machinery of a steam carriage should be made twice as strong and heavy as is necessary for impelling it with safety on a tolerably level road, merely that it may have power within itself for going up a few occasional hills, or whether it is better to make the machinery lighter, and take the occasional assistance of a pair of post horses? There can be no objection to the latter expedient, except the expense of such horses; and as the steam coach can carry goods to profit in place of all the weight of machinery which is saved by making it lighter, I think that the aid of post horses would be an economy. In forming such an opinion, I have followed a maxim which I had always found to hold true; viz. that steam power is certain to be more profitable than horses, if the work is to be kept constantly going on, because then the great advantage of steam power, that it does not tire, becomes fully available; and to perform the same service by horses, a very great number must be kept for change; but for business which requires only occasional working, or for working during only as many hours each day as horses can do without changing, steam power loses its great advantage over horses, and in some cases they will do the work cheaper. One great item of the expense of steam power is the first cost of machinery and engineers' wages; both which would be only the same for working twelve hours per day, as for one hour and a half, which is the utmost that a stage coach horse can draw at ten miles an hour. A steam coach should work twelve or fourteen hours in every twenty-four hours, to gain the full advantage of the system of steam power over horse labour; the intervening ten or twelve hours will allow ample time for putting every thing in perfect order for the next journey, if the machinery is what it ought to be, and there should be a spare coach for every two which are running, to allow time for more considerable repairs: hence, I reckon that three steam coaches should keep up a double passage of 100 or 120 miles a day continually. Expensive machinery, which is only to be worked occasionally, will not, in some cases, do work so cheap as it can be done by men or by horses without machinery; and that I conceive to be the case with the extra cost, weight, strength, and complication, which must be given to the machinery of a steam coach, in order to enable it to go safely up steep hills without assistance. I apply these remarks to the present steam coaches, but future improvements may in time produce that species of machinery which will effect the going up hill with less difficulty than the present. It has been supposed that the diameters of the cylinders being larger than is necessary for going on level ground, they could be worked with a diminished strength of steam to go on level ground, and stronger steam when going up hill. To get up ordinary and moderate hills, that is certainly the right plan; but it requires the strength of all the moving parts of the engines to be made sufficient to bear the utmost force that the

pistons can exert when impelled by the strongest steam that is ever to be used; also, the large wheels which run upon the road should be made very broad on the edges, and of proportionate strength. The present coaches have been faulty in these respects, and yet the machinery is too heavy. Another way of getting sufficient power to go up hill is to have the pistons only a suitable size for going along the ordinary road, and to introduce wheel work, which can be thrown into action when a hill is to be ascended, and which will turn the wheels of the carriage round only once for three turns of the cranks of the engine, and consequently with a triple force. Mr. Hancock has shown me the parts of such machinery which he is now making for a new steam coach, with wheel work and endless chains, on a plan which I think very likely to answer for ascending moderate hills; but for very steep hills, I think it is desirable to have the help of post horses. The immediate desideratum is, to construct a steam coach with the power and strength necessary to go quickly and safely along the best lines of road which can be found, without any steep hills upon them, taking the assistance of post horses where it is necessary. If that is accomplished, and such a coach is worked continually for two or three years, it would probably lead to the knowledge of the proper kind of machinery to go up steeper hills; but if the adoption of steam coaches is to wait until they are rendered much more perfect, it will be a very long time, because practice is essential to finding out a proper plan."

"Do you think there is any danger in going down a hill in a steam carriage? Much less than in a common stage coach, for by backing the engines, so that their power is brought to act in opposition to the turning round of the wheels, and with the assistance of drags, or brakes, to rub on the rims of the wheels, and aid in retarding their motion by friction, steam coaches will safely go down all moderate hills, such as are met with on our best lines of turnpike roads, say between London and Holyhead; and with machinery such as Mr. Hancock is now making, if it is suitably proportioned, I expect a steam coach would not require assistance to get up a hill at more than five or six places between London and Holyhead."

The information given in relation to ascending and descending hills, having a local reference, we give only the general results.

A hill of the slope of one in eighteen, (about 3° 10′,) Mr. Farey considers too steep to be ascended by locomotives in their present state, without risk of fracture, unless assisted by horses, the road not being supposed of the best sort. They could ascend a hill of one in thirty, (about 2°,) without assistance.

We return to the printed evidence of Mr. Farey.

"Have you turned your attention to the subject of apportioning the tolls on steam carriages, so that they may bear their due proportion to the tolls on carriages drawn by horses? No, I have not paid much attention thereto, it is a subject which would require more consideration and more data than I have before me. I am convinced that if a steam coach, complete when travelling, weighs no more on an average than a stage coach with its four horses complete weighs on an average, there is no reason for charging any extra toll for steam coaches, but, on the contrary, I believe it will turn out in the sequel that they ought to go for less toll, because they will wear the roads less than the present coaches whenever they are made really efficient; and, in the mean time, until that is accomplished, I think it may be very safely left to the chance of events as to injuring the roads to any extent whatever, by injudicious attempts to work steam coaches of an injurious construction; from the consideration that if any new coach which may be started, does injure the road, it will be very soon given up from its own demerits, probably before it has produced any visible effect on the road. Suppose its wheels were to slip so much as to plough out ruts on

the road, it would most probably stick fast, or be broken to pieces in the first journey along the road, and such abortive attempts will not be repeated very frequently. It is idle to talk of one or two steam carriages doing much visible injury to a frequented road in a year or two, even if they run constantly, for suppose that each one wears the road four or five times as much as one carriage of the same weight drawn by horses (including those horses in the weight,) it would only be equivalent to four or five additional coaches passing each day, and that on the road from London to Birmingham, for instance, would be quite imperceptible. I am confident that any steam coach which does a road any greater damage than is equivalent to that done by carriages drawn by horses, will fail of itself in a short time, and prove an unsuccessful project. I should strongly recommend the new system to be left to its own chance of success or failure, as far as the roads and the safety of passengers are concerned; and I think the same reasoning applies against any regulation for the breadth of the wheels for steam carriages, because they will not perform well if their wheels are so narrow as to cut the road materially. I understand that the old system of regulations and penalties, as to over weights on given breadths of wheels for common carriages, has been done away with on the roads in an extensive district round London, and I think it is good policy, from the circumstance that the proportion regulates itself by the interest of the owners of carriages, when the fact is understood that carriage wheels, which are too narrow in proportion to the load on them, and to the hardness and goodness of the road, will always draw more heavily than wheels of a suitable breadth; and that, though the carriers may not find out the proper breadth at once, they will do so in the end. The old acts for forcing the use of very broad wheels by making tolls operate as penalties and premiums, was a most injudicious system of legislation, and did nothing but harm; the carriers soon found out how to evade the intention of the act, by using very broad conical or barrelled wheels, rounding on the edges, which conformed to the words of the law, but which acted on the road like narrow wheels. The broad wheels intended to have been encouraged by the old act of parliament, were expected to act as rollers to make and improve the roads, and were encouraged to carry excessive loads for that object; but if the wheels of the broad wheeled wagons not actually used had been really such as the legislature contemplated, they could have been continued in use on account of the great increase of draught; but the broad wheels actually used, carried such loads, that they crushed the road materials to powder, owing to the conical form of the wheels and the bending of the axletrees; they bore on the road almost wholly at the inner edges of the iron tires, and not across all their breadth, as was intended. The advantage to the carriers in tolls, and in increased loads, induced them to use such broad-wheels, when it would have been against their interest to have done so, if they had paid the same tolls for the weight of goods as other carriers, and their operation on the road was more injurious than that of any other carriages. There is no particular breadth of wheels which can be prescribed as the best to carry given loads over all sorts of roads, for much depends upon the hardness of the road materials, the size to which the pieces are broken, their general form and disposition to consolidate into a hard bed, the resistance the materials offer to wet and frost, and to wearing by the wheels; the breadth of the wheels, and the load upon them, should be adapted to all the combinations of circumstances, and the carrier will soon find, if his wheels are not best adapted to the road, by the draught being greater than it ought to be. As to steam coaches, the wear which will take place on roads, from all that can, by any probability, be expected to be brought into use for some years, will be so small that it cannot be felt for a considerable period, and when it is felt, it will be time to look round and see what is the real effect on the roads of those particular coaches which are in use, and apportion the tolls that they ought to pay."

"Is it your opinion that weight for weight, including the weight of horses on one hand, and of engines, and an average of the water and fuel on the other, the tolls should be the same on steam carriages as on horse-drawn carriages? I

think that if it were so it would prove a considerable advantage to the roads, because as I have stated before, I think the roads will be considerably benefitted by the change of impelling by steam instead of by horses. I think it will be a great public benefit when steam coaches come into common use, and hence that it is expedient that a moderate bounty should be offered for the adoption of steam carriages, by giving them all possible advantage they can have without trenching on the interests of individuals; and if they were allowed to run toll free, and duty free, until a certain number were in use, or during a certain time, it would much accelerate their introduction, because it would diminish the loss that must necessarily be incurred by running them before they are perfected in their construction. Small encouragements or discouragements have a considerable effect on new inventions in their infant and imperfect state. The advantage to the public from steam navigation is now generally acknowledged, but when steam-boats were in their infancy, an attempt was made by the watermen on the Thames to suppress them, by contending that, according to their charter, and the usage of the city of London, no persons could be allowed to own a vessel plying for passengers on the Thames, nor to work on board of such a vessel, except they were freemen of the city, and belonging to the watermen's chest. This would have effectually prevented any engine men being employed, and, in addition, the watermen engaged all their members to refuse to navigate them. After a long dispute and delay of the steam-boats, it was decided that one out of a number of owners being free was sufficient, and that the men employed to manage the engines were not subject to the watermen's regulations of freedom of the river; some watermen were induced, by giving them small shares in lieu of wages, to exercise their right of freedom in favour of the real owners, and to navigate the vessel. It was afterwards attempted to get the measurement and calculation for the registered tonnage of the steam vessels made according to the extreme breadth across the projecting boxes which contain paddle wheels, under the pretext that they occupied that width in the river and in harbours, instead of measuring the breadth of the vessel at the surface of the water. If that could have been enforced, it would have nearly doubled all the rates on steam vessels, compared with other vessels; but the subject being brought before parliament, an act was passed to give them the advantage of deducting as much from the length of the vessel as is occupied by engines and machinery in calculating the registered tonnage. This was, in effect, a small bounty upon steam vessels, for they have no claim to such an advantage over sailing vessels; when the weight of masts, sails, and rigging, in the latter, is not deducted in calculating their tonnage. The effect of that measure has been favourable to the advancement of steam navigation, for though it was but a very trifling bounty, and is now of no consequence, it came as a well-timed aid, at the date when that act passed, because almost all steam vessels were then navigated at a loss, they were so imperfect (like steam coaches at the present day,) that their engines were continually getting out of order, whereby they failed to make their passages, and required expensive repairs; their consumption of fuel was great, and the wear of boiler excessive. On the other hand, few passengers would go in them at first, and some terrible accidents which happened in a few vessels, caused them all to be avoided by passengers for a long time. It was only by persisting in keeping them going as well as they could, and thereby gaining experience in their management, that the numerous defects of their construction were remedied. Most of the earliest steam-boats had two or three successive editions of engines and machinery before they were rendered so perfect as to become profitable; and, in addition to the expenses of such alterations and improvements in the machinery, they were obliged to make their passages regularly for some time after they were rendered tolerably effective before they acquired sufficient confidence with the public as to their safety and punctuality, to enable them to obtain as many passengers as would pay the expenses of navigating the vessels. For all these reasons any increase of their expenses was severely felt at that losing period; many

were abandoned, and the difference in the expenses occasioned by the rates to which vessels are liable, being calculated according to the breadth across the paddle wheels, or according to the act passed for measuring them short by all the space taken up by the engines, would have occasioned others which have been brought to bear to have been given up, before they had attained so much perfection as to enable them to earn their expenses. In the same manner the tolls levied upon steam coaches at present are to be regarded, not as payments out of the profits of a gainful trade, but as an increase of loss upon that which is yet, and which must inevitably continue to be for some time, a losing business. The ultimate success to which I look forward is entirely dependent on the circumstance of the first speculators in steam coaches being enabled to go through a sufficient term of inefficient performance, and consequent loss, to acquire experience in the new business; and that experience will, no doubt, lead to expensive alterations and re-constructions of their machinery. There is so much mechanical talent to be had for money, that I have no doubt of the final accomplishment, if the attempts now making are continued long enough; because I am confident that there is (as was the case in steam-boats) a real efficacy in the principle of action. The general opinion of engineers was not very favourable to steam-boats, when they were first brought forward as a novelty; many doubted if they could ever be made to perform well, particularly at sea; and others, who foresaw the possibility of that, doubted whether they would answer in point of expense of fuel; and wear and tear of engines and boilers. If no assistance or encouragement is given to inventions when they are in the infant state which steam coaches are now in, persons who find that they only lose money when they expected to gain, by being the first to adopt the improvements, are liable to become disheartened, and give up the pursuit too precipitately, whereby their undertaking dies a natural death; and that is sometimes the case when it might have been established by another two or three weeks' continuance of the efforts; and that continuance might be induced by some small relief, like the reduction which was made by parliament in the register tonnage of steam vessels, or the taking off of the tolls from the earliest steam coaches. If by any means they are enabled to go on till the proper plan of machinery and management is found out, they will afterwards keep their ground, because the profit of working by steam in lieu of horses will be very great. The present steam coaches are mere experiments, and the next editions of each plan of them will, I expect, be losing concerns, and will continue so to be for some time. Under those circumstances, every small increase of their expenses is a real retardation to that practical establishment of the invention which will render it useful to the public; such retardation by small causes is operative to a greater extent than can easily be conceived. Steam coaches will very well bear all tolls and taxes to which other coaches are subject, when they are able to carry passengers regularly and profitably; but they want encouragement now, instead of difficulties being thrown in their way. As to the right of tolls on turnpike roads, it should be recollected that turnpike roads are not property, like canals, but trusts, to be exercised for the benefit of the public; and if it is for the interest of the public that steam coaches should be brought into use, and if that bringing into use will be accelerated by suspending the tolls on them at first, the trustees of roads ought not to object to such an arrangement. The real amount of tolls they will forego, will be an exceedingly small per centage on the income of their tolls; for so long as steam coaches are losing concerns, they cannot be very numerous."

"In the course of your examination, have you meant to confine your evidence to steam coaches? Yes, to steam coaches for public conveyance of passengers and parcels, in the manner of stage coaches, and travelling at the rate of ten miles an hour on our best lines of turnpike roads, with occasional assistance of one or two post horses, where necessary, to surmount unusual hills, or very bad pieces of new laid road. If it were thought admissible to begin with travelling at a less speed than that, and to carry goods only in the manner of vans, the

thing is nearer to accomplishment, because the accommodation and comfort of passengers would then be out of the question, and also the violence to which quick travelling carriages are subjected, requires a greater strength of all the parts than would be necessary to carry the same weight at a lower speed. In other respects steam power will propel a carriage as cheaply at a quick rate as at a slow rate. That fact is proved on rail-ways, in actual business; and steam coaches will be the same whenever they can be made strong enough to bear quick motion without being overloaded with weight of machinery. That will be one of their great advantages over horse labour, which becomes more and more expensive as the speed is increased. There is every reason to expect, that, in the end, the rate of travelling by steam will be much quicker than the utmost speed of travelling by horses; in short, that safety to travellers will become the limit to speed, as is now the case on rail-ways."

"What is your opinion as to impelling wagons by steam? I have never considered that at all in detail, and am not prepared to give evidence upon the subject. The price of carrying passengers or goods at a quick speed, as is done by stage coaches, or vans, will always be so much higher than the prices of carrying an equal weight at a slow speed, as is done by wagons, that I see no inducement to attempt steam wagons, which I think would present almost all the difficulties of steam vans. According to theory, the cost of carriage by steam will, as I have stated, be proportionate to weight and distance, without regard to speed of motion; for instance, to convey a coach loaded with two tons for a distance of ten miles only, the same fuel will be consumed, and the same wear of machinery will be occasioned, whether that distance is run in one hour or in four hours. The wages of engineers, conductor, and guard, will be only one-fourth with the quick speed, and the first outlay in machinery would be only one-fourth, because four times as many engines must be on the road, with their attendants, at the same time, to do the work at a slow speed, as at a quick speed; but the money earned by the carrier at the slow speed, will be only a small part of what would be earned at the quick speed."

"Taking into consideration the comparative expense of horse carriages and steam carriages, do you suppose that steam carriages will be able to run for half the charges of horse carriages? My own idea is, that steam coaches will, very soon after their first establishment, be run for one-third of the cost of the present stage coaches; but to become a business at all, it must necessarily be a business which will offer strong inducements to persons to embark in it, and to do that, the rate of profit must be very much greater than that which is commonly expected to be realized by the proprietors of stage coaches. Their present trade affords a less profit on the capital and trouble of management probably than any other sort of business which is carried on with spirit in this country. The great reason of that is, the constant loss by destruction of horses, the fluctuations of the price and quality of horse-keep, and the impossibility of reducing stage coach establishments in times when travelling business is flat; because the horses must be kept, and men to attend them, at all events, and the loss of running a coach half employed is not so great as suspending it, and keeping the horses idle on short allowance till better times come round. The profit of stage coaches which load well is very high, particularly in the fine travelling season, and that occasional profit creates an excitement which induces the injudicious to set up more coaches than are wanted for an average of all seasons; and for the reasons above stated, their expenses when onee set going, cannot be reduced to meet bad times. The adoption of steam coaches will set the trade free from its great commercial difficulty, because they can be laid up and kept idle without considerable loss, and brought out again when wanted without any new outlay; also, fuel does not fluctuate either in price or quality to any considerable extent, like horse corn. In short, the capital embarked in a steam coach trade will not be so rapidly wasted as at present in horses. Owing to the great number of horses which must be first bought and then kept to do the same work as one steam coach, the first outlay in stock will be very small

in steam coaches, compared with horses, the same of stables, hostlers, and harness. The daily expenses of fuel and attendants will be very much less than that of horse keep and attendance; the wear and tear of the coaches, and all that is coachmaker's work, will be only the same as at present, but the wear and tear of engines and machinery, though a very expensive item on each engine, will be nothing to compare with the present repairs, loss, and decay of horses, because the number of engines is so small. Stage coach horses require to be all renewed every three years, notwithstanding a heavy annual expense for what may be called repairs of horses: viz. harness, shoeing, and farriery. Engines with an equally heavy annual expense of repairs to that of horses, will, when perfected, be kept up thereby in such a state as to last for many years without renewal. The metal parts of machinery only wear at particular places, which are capable of being repaired or renewed, so that they become as good as new; but a horse, when worn to disease at any part, feet, eyes, or lungs, becomes incapable of stage coach work forever afterwards."

"Do you apply the principle you have stated respecting the probable wear of the roads by steam power being less than by horses, to heavy wagons? Yes: my proposition that the wear of the roads will always be at the expense of the carrier, applies to all carriages whatever, but more particularly to those impelled by steam than to those drawn by horses, because carriages drawn by horses may be so mismanaged, as to do very great injury to the roads, and yet may make good progress in travelling. For instance, a wagon having very narrow wheels, carrying a heavy overload, having a sufficient team of strong heavy horses, may be drawn along although it breaks the road up to any extent, and that as much by the feet of the horses as by the narrow wheels; but, if it were attempted to impel the same wagon by steam power acting by the adhesion of the wheels to the road, they would slip round, and it would not get along the road. I am confident that carriages to be impelled by steam machinery turning the wheels, cannot be made to answer any good purpose, either for conveyance of travellers, or goods, so long as they materially injure the roads, because if the wheels slip materially on the road, or if they cut sensible ruts in the road, they will not advance the carriage efficiently. On the other hand, horses may be made to draw a carriage which will injure the road. I think that principle must apply to steam wagons as well as to steam coaches."

"The heavier the loads to be drawn, the more important it is to apply steam instead of horses, if the roads will be benefitted by that substitution? I think so, as far as the roads are concerned, but I doubt if steam wagons will offer any comparison of the profit to be derived from steam coaches. To get along the road, steam wagons will require very broad wheels, and there is no danger of doing injury to the road by them, for they will not get along if the wheels are too narrow, but narrow wheeled wagons drawn by horses may do an injury to any extent, for extra horses may be put on, and they will injure the road with their feet, at the same time that they draw a carriage after them which also injures the road. It will be a loss to the carrier to do so, but there is nothing in the nature of the operation to prevent it being done, as there would be in the case of steam wagons."

"Of course, a steam carriage going slower than ten miles an hour will be more expensive to travel, on account of the greater expenditure of fuel? No; the consumption of fuel, according to time, would be as much less as the motion would be slower; so that the consumption of fuel, according to distance, would be the same, whether for a quick speed or for a slow speed; but when profit is considered, every thing is in favour of quick speed; because all goods carried slow must be carried cheap; and quick conveyance will bear the highest price of carriage, on account of the expense of going quick by horses. For instance, a ton of goods may be carried a mile by steam power with a certain consumption of fuel, but it should take no more fuel to carry it a mile, at the rate of two and a half miles an hour, than at ten miles an hour. There is some qualification to be made in that statement according to the state of the roads; it will be true

if they are hard and good, but if they are heavy, the expense of fuel will be a little more for the quick speed than for the slower speed; and it is also to be understood, that the engines must be suitably proportioned for attaining quick speeds, because engines, which are only adapted for slow motion, do not work to so great an advantage when they are urged to work quick as when they are worked at or below the speed which the proportions of their parts are adapted to move with; nevertheless, that extra expense of going quick by steam power will be but small, and nothing like the increased cost of travelling quick with horses; for horses have only a limited speed at which they can travel, if they have no load to carry or drag after them, the whole of their muscular strength being then required to advance the weight of their own bodies. The speed with which stage coaches now travel, approaches so near to the speed with which the horse could travel without any load, that their force of draught becomes very small. In all cases, horses lose force of draught in a much greater proportion than they gain speed, and hence the work they do becomes more expensive as they go quicker. The quickest stage coach travelling is now at the rate of eleven miles an hour, and that appears to be very near to the utmost limits which nature has prescribed for animal exertion; for those horses require renewal of the whole stock every two or three years. This is the comparison of steam power and horse labour, during the time that each is actually in operation; but the real difference between the performance of a steam engine and that of a set of horses will be found to be very great, when it is considered, that, by having one spare steam coach for every two or three which are on the road, those coaches can travel continually all the year round, during fourteen or fifteen hours in every twenty-four hours, without any intermission, except stopping for one or two minutes to take in water at every stage of about seven or eight miles; and thus each steam coach can travel 140 or 150 miles a day, whereas a set of four stage coach horses can only work during seven hours and a half out of every twenty-four hours, or each horse can run fifteen miles a day, and that exertion wears them out very soon. A cart horse, travelling at the rate of two miles and a half an hour, can work during eight hours out of every twenty-four hours, or he can travel twenty miles in a day. Suppose that in both cases, of horses going ten miles an hour, or only two miles and a half an hour, the force of traction was the same during the time that they were actually drawing; even on that supposition, there would be the difference between twenty miles a day and fifteen miles a day in favour of slow travelling; but in considering the work performed, the great loss in the force of draught by quick travelling must be taken into account; and it will be found that a cart horse walking at two miles and a half an hour, could draw with a force of traction 100 lbs. on an average, but that a stage coach horse, running at ten miles an hour, cannot exert more than 28 lbs. force of traction at an average. The above proportion of distance travelled, and force of traction exerted in each case being combined into one product, the portion will stand thus: 20 miles a day $\times$ 100 lbs. draught $=$ 20,000, to represent the work done by a horse travelling at the rate of two miles and a half an hour, and fifteen miles a day $\times$ 28 lbs. draught $=$ 420 to represent the work done by a horse travelling at the rate of ten miles an hour, which is four and three-fourths to one in favour of a slow speed; when with steam power there would be only a very slight difference of performance at the quick or the slow speed."

"Respecting the injury done to the roads by heavy carriages, whether they are drawn by horses or impelled by steam power, you consider that weight for weight (including horses and engines as part of the weight) the one will not do more injury to the road than the other? In my opinion, the steam carriages will do the least injury of the two. The horses, by treading with their feet, excavate and scrape out depressions in the surface of the road; that is particularly the case before the road materials are consolidated into a solid mass; and the evil of depressions or holes in the road is not the mere injury done by the feet of the horses to those particular parts of the road in which the depressions

are made, but the wheels of other carriages which pass over such depressions, drop heavily with force into them, so as to make the depressions continually deeper and larger, and to loosen the surrounding stones. In this manner the horses, after injuring the road themselves, prepare the way for further injury to the road by the wheels of carriages. To have the full benefit of the rolling action of the wheels in consolidating the road materials, the latter must be laid smooth and level before the wheels come upon them; but if the materials are previously thrown up into little hills and holes, the wheels will do mischief instead of good."

"Suppose the engine and machinery in a steam carriage to weigh two tons, and to be able to advance an additional load, equal to their own weight, along a good road, at an average speed of ten miles an hour, do you think that any additional toll should be imposed upon steam carriages beyond that paid by four horse stage coaches, or vans; assuming the four horses to weigh two tons, and to draw a load of two tons, at the rate of ten miles an hour? In such a case, I can see no reason whatever for any increase of toll; but the diminished wear of the roads, which I anticipate from the use of steam in lieu of horses, will be a reason for a reduction of tolls whenever such a diminution of wear is realized."

"Would horses drawing eighty cwt. upon a road, with a slow walking pace, in your opinion, do more injury to the road than an engine doing the same work? I have had no experience of drawing heavy weights by steam to enable me to form an opinion respecting the effect that the broad wheels, which must then be used, would have on the road, and what advancing power they would have before they began to slip on the road, without advancing the carriage forwards; nor what would be the weight of engines which could advance eighty cwt. at a slow speed. I feel some doubt of the practicability of making steam engines advance so many times their own weight, as I expect this would be, with effect, and I feel confident that, in the present state of the art, there would be no profit in doing it; but if it were accomplished, I believe that the broad wheels of the steam wagon would do no injury to the road, whereas, in heavy wagons, drawn slowly by horses, the horses do much more injury by digging and scraping with their feet than is done by the horse in coaches and vans travelling quickly; because the wagon horses having a heavy pull to make must choose places in the road where they can place their feet in depressions, in order to get hold; hence, on a good smooth road they slip and scrape up the surface."

[TO BE CONTINUED.]

Tract on Comets, and particularly on the Comet that is to intersect the earth's path in October, 1832. *By M. Arago. Translated from the French, by John Farrar, Boston,* 1832.

We avail ourselves of the privilege afforded by our title page, in which our devotion to general science is expressed, to give a notice with extracts from an essay on *comets* lately set forth by the French philosopher Arago. This tract comes to us in an English dress through the translation of Professor Farrar, of Cambridge, Massachusetts: it was, in the original, an essay in the almanack for 1832, published by the French Board of Longitude.* It would be thankless in us, after having the labour of translation done for us, to find fault with the manner of its execution; besides, we know experimentally

* Mémorial du Bureau des Longitudes, 1832.

the difficulty of avoiding gallicisms in a translation from the French; we may, notwithstanding, venture the remark that the French astronomer would have appeared better, before the American public, if a few of his national peculiarities had been softened down to suit the more frigid temperament of his new readers.

The comet which was the "exciting cause" of this essay by M. Arago, is one which unassisted eyes are promised a sight of in the months of October and November of this year; not, as a widely spread two-penny tract would have us believe, growing in size until it rivals the full moon in shining, and with a tail overspreading half the heavens, but with even more modest pretensions to notice than when it last visited us in 1826. The humble little publication to which I have just referred, after exciting our consternation by the description of a mighty monster, gravely tells that it cannot hurt, and that as harmless as the bright moon itself it will decrease as it had increased, and disappear from our astonished sight.

The veritable account which M. Arago gives of this comet is as follows.

Comet of Six Years and Three Quarters.

"We have now come in our account of comets to another periodical one, which is to reappear, like that just described, in 1832, and whose near approach, we are told, will be attended with fatal consequences to the earth and its inhabitants.

"This comet was discovered at Johannisburg on the 27th of February, 1826, by M. Biela, and ten days afterwards at Marseilles, by M. Gambart. The latter calculated the parabolic elements without delay, by means of his own observations, and immediately perceived, on consulting the table of the elements of comets, that this was not its first appearance, but that it had been already observed in 1805 and in 1772.

"The comet of 1826 is therefore periodical.

"It was accordingly necessary to change the parabolic elements into elliptical elements, in order to discover the length of the comet's orbit left undetermined by the former. Messrs. Clausen and Gambart undertook this calculation, and each found, at nearly the same time, that the new comet made a revolution round the sun in about seven years.

"This curious result was adopted without dispute; for, in 1826, astronomers were cured of their old notion that the revolution of a comet must *necessarily* be very long; while, from the example of the comet of 1770, it was deemed imprudent to venture to determine the time of the future reappearance of a new comet, before all the derangements and perturbations to which it was liable in its whole course, had been thoroughly studied. My colleague, M. Damoiseau, undertook this long and minute calculation, the result of which is as follows.

"The comet of six years and three quarters will cross the plane

of the ecliptic, that is, the plane in which the earth moves on the 29th of October, 1832, before midnight.

"The earth, during its annual course round the sun, never leaves the plane of the ecliptic; therefore it is only somewhere in this plane that a comet could strike it; of course, if we had any thing to fear from the comet of 1832, the danger would be on the 29th of October, before midnight.

"Now let us inquire whether the point, at which the comet will cross the plane of the ecliptic, is near the path that the earth describes; for, in order that there may be a meeting between the two bodies, this is as necessary a condition as the other.

"Upon this point it is proved, by calculation, that the passage of the comet through the plane of the ecliptic *will be a little within our orbit, and at a distance from it equal to two and a third of the earth's diameters, or* 18,500 *miles.* It is possible that this distance, already so small, may disappear entirely, if we suppose certain small variations in the elements, given by Damoiseau, which it is difficult to answer for.

"Let us, however, take two diameters and a third, as the real distance; we must remember that this has reference to the centre of the comet, and we must ascertain whether its size is large enough for any part of it to extend to the earth's orbit.

"When this body appeared in 1805, the observations made by the celebrated M. Olbers, of Bremen, gave for the semidiameter of the comet two diameters and two thirds of the earth. From this number, compared with the preceding, it plainly results, that on *the* 29*th of next October, a portion of the earth's orbit will be comprehended within the nebulous atmosphere of the comet.*

"There remains now but one more question to answer, it is this: At the time when the comet will be so very near our orbit that the nebulous or hairy *atmosphere* will cover some part of it, *where will the earth itself be?*

"I have already said that the passage of the comet very near to a certain part of the earth's orbit, will take place on the 29th of October, before midnight; well, the earth will not arrive *at that same point*, until the 30th of November in the morning, that is, *more than a month afterwards!* Now we have only to call to mind that the average rate at which the earth moves in its orbit is 1620 thousand miles per day, and a very simple calculation will show, that

"*The comet of six years and three quarters will, during its appearance in* 1832, *be always more than forty-eight millions of miles from the earth.*

"In order to ascertain the least distance of the comet from the earth in its future returns, the same calculations must be made. If in this year, 1832, instead of passing the plane of the ecliptic on the night of the 29th of October, it reached that point on the morning of the 30th of November, it would certainly mingle its atmosphere with ours, and perhaps it would strike us. But I hasten to assure the public that a mistake of a month, in determining the time when a comet reaches its node, is impossible. I have confined myself in this ac-

count to what relates to the body of the comet, because no trace of any tail has ever been seen to accompany it in its former visits.

"The reader is now in possession of all that can interest him with respect to the course of the comet of October, 1832. The foregoing facts do not differ from those which M. Olbers published in a note, the meaning of which has been so strangely mistaken by the public and by several journalists. Shall I be more successful in my endeavours to explain myself? I hope so; but I cannot be very confident so long as there are persons who, believing that the earth will not come in contact with the comet or receive any direct injury from it, yet think that the comet cannot cross the earth's orbit without altering its form, as if this orbit were a material substance; as if the parabolic line described by a bomb through the air, when discharged from a mortar, could be affected in its course by other bombs having formerly been projected through the same space."

We find then that this comet will never be nearer to us than forty-eight millions of miles; within only twice this distance we perform our round unharmed about the great central fire, in obedience to the attraction of which the comet, as well as ourselves, moves.

As the calculation of our security from ill effects by collision with the comet rests upon the time at which it will intersect the earth's orbit, M. Arago proceeds, by way of rendering assurance doubly sure, to examine the causes which might be said to cast a doubt upon the conclusions which he has stated. The first of these alleged sources of error is the effect of a resisting medium in the planetary spaces, which, by retarding the comet in its course might be supposed to bring it *later* to the earth's orbit than the time calculated. As we see the velocities of bodies diminished by resistance, this idea seems at first plausible, and we abandon it only after finding the imperfect nature of the reasoning by which we drew our conclusions. The effect of a resisting medium would be to decrease the force by which the comet tended from the sun; it would therefore be drawn nearer the sun, and, hence, be made to describe a smaller orbit, and with an increased velocity. The effect then of such a resistance would be to cause the comet to arrive sooner, instead of later, at the earth's orbit, and in this case to increase the distance between it and the earth. Comets become interesting in a scientific point of view as enabling us to detect the existence of this very attenuated medium which fills space, and the experiments of modern astronomy are employed in studying the question. Already Encke's comet has shown in its frequent returns (every three and one-tenth years) a small acceleration of about two days, which Encke considers attributable to this cause.

It is not our purpose to follow M. Arago in the various questions which he examines; our readers who feel disposed to look over these will find wherewith to amuse and to interest, plainly set down; they will see that astronomers as well as poets give the rein to imagination, and will find, with them, how limited a view our intellect can take of the vast phenomena of nature.

It may not be amiss to state that M. Arago examines the following among other questions, and proves clearly by facts that a negative answer must be returned to each and every one.

Do comets affect the seasons? Was the fog of 1831 produced by the influence of a comet? Has Siberia changed its climate from a similar influence? Is it necessary to resort to the influence of a comet to explain the severe climate of North America?

We will not quit the subject without a word upon the (so called) lost comet of 1770. It affords a fine instance of the grasp of human intellect, and is well calculated to inspire us with confidence in the results of the calculations of astronomers. It shows us, also, how inconsiderable must be the masses of these bodies which once inspired such terror in our race.

Between the months of June and October, 1770, a comet was visible, the orbit of which was found, by calculation, to be an ellipse, in which the comet made an entire revolution in five and a half years. The facts that this comet, though of so short a period, had not been recorded as visible previous to this time, and that it was not visible in 1776 (five and a half years after its first appearance,) threw a doubt upon the calculations of Lexell, and induced the Institute of France to propose a prize for a complete investigation of its orbit, to include the perturbations to which it might have been liable. Burckhardt, by the aid of certain analytical formulæ of La Place, was enabled to solve the mystery which hung about this comet. The orbit found by Lexell was confirmed as the true one, and in tracing back the course of the comet in this orbit, prior to its appearance in 1770, Burckhardt ascertained that in 1767 it had been within the sphere of attraction of the planet Jupiter, the attraction of which planet, at the nearest approach of the comet to it had been three times that of the sun. By means of the analytical processes to which we have before alluded, Burckhardt was enabled to determine that had the comet been, prior to 1767, moving in a large orbit, of which the least distance from the sun was greater than that of Jupiter from the same body, and in which its period was fifty years, the attractive force of the planet would have been sufficient to draw it into its new orbit, the least distance of which from the sun was less than the radius of the earth's orbit. The comet was not seen prior to 1770 on account of its great distance from the earth, which distance, when at the smallest, exceeded that of the planet Jupiter. Next by following the comet in its orbit, in 1776, when it should have reappeared, Burckhardt found that the sun was interposed between the earth and the comet, so as to render the latter invisible. The non-appearance in 1776 was thus accounted for. But why has the return of this comet not been noticed? An answer was also given to this question. The time of revolution of the planet Jupiter in its orbit is about twelve years; hence in 1779 the comet came a second time within the influence of the attraction of the planet, but in different relative situations from those which had occurred twelve years before; the attraction of the planet was exerted sensibly for nearly five months, and the orbit was again changed. The least distance of this new orbit

from the sun is not nearer than the planet Ceres, and the time of revolution about twenty years. Unless this comet should again be subjected to perturbations bringing it nearer to our part of the planetary system, it cannot again be visible from the earth.

The inconsiderable mass of the body just spoken of, is proved by the fact that while the attraction of the planet Jupiter caused such entire changes in the orbit of the comet, the latter did not perceptibly affect the motions of the planet, and not even those of its satellites. We are prepared from these observations to expect the result which the calculations of La Place gave, in relation to the effect of this comet on the earth's motion, namely, that passing as near to the earth as fifteen hundredths of the earth's distance from the sun, and having its own period of revolution affected two days by the earth's attraction, the reciprocal effect upon the earth's motion was insensible.

B.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN MAY, 1832.

With Remarks and Exemplifications, by the Editor.

1. For a *Mill for Grinding Grain, Paints, &c.;* William G. Johnson, city of Philadelphia, May 3.

This mill is to be constructed in the usual manner, excepting the apparatus for pressing the stones together, which apparatus, we are informed by the patentee, consists of a horizontal lever, a regulating screw, compound levers and weights, and a moveable and fixed collar.

In form and action this apparatus bears a near resemblance to the governor of a wind mill, or steam engine, but it is not made to revolve, being acted upon in another way. When the stone is raised, it presses against a lever, connected with the governor, and this throws out the two balls, or weights, causing them to act with greater force, upon the stone, and thus prevent its further rise. The effective pressure upon the stone is in this way increased, or diminished, as it rises from, or approaches towards, the bed stone. It is this particular arrangement which forms the subject of the claim.

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2. For *Applying Wind to the Propelling of Boats, Vessels, or Land Vehicles, Mills, Lathes, and other Machinery;* Benjamin Dugdale, city of Trenton, New Jersey, May 3.

The specification of the machinery employed does not make its structure clear, says nothing of its mode of operation, and lays no claim to any part of the apparatus. The drawing, in our judgment, throws but little light upon the subject, as it has not enabled us to perceive how the patentee intends that his machinery shall operate in propelling. Its general appearance is that of the horizontal wind mill, but we see no contrivance for feathering the sails. There is a

vertical shaft, from the upper end of which project ten, or more, horizontal arms, and a corresponding number at a proper distance below. Iron rods extend from the extremities of the lower to the extremities of the upper arms, thus forming the skeleton of a lantern. Sails which may be lowered or raised by means of pulleys, and which have rings on their edges that slide on the iron rod, form, when raised, pannels all around the lantern, and present to us a regular polygon. We leave to others to divine how boats, vessels, land vehicles, mills, lathes, and other machinery, are to be propelled by this contrivance. Could we discover in what way the wind is to operate upon the sails, we could tell how to apply their revolution so as to effect some of the ends proposed; even then, however, we should be obliged to leave the boats and vessels out of the question, unless we were permitted to locate our wind mill on the shore, and to extend a tow line from it to the vessels on the water.

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3. For an improvement in *Saddles*; George Pritchard, Clarksbury, Harrison county, Virginia, May 3.

Steel springs are to be formed by winding pieces of wire, of one-eighth of an inch in diameter and five feet long, round quadrangular bars of iron, five-eighths of an inch wide and three-eighths thick. Two of these springs are to be used with each saddle. They are to be fastened by one end under the cap plate, and on the head of the tree, and by the other to webbing attached to the cantle in the usual manner, thus giving a high degree of elasticity to the seat, which cannot exist when the webbing extends to the head of the tree.

The patentee alludes to other modes, previously patented, of fixing elastic springs to saddles, but considers that just described as more durable, and as preferable on several accounts.

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4. For *Machinery for Liming and Handling Skins in Tanning;* Caleb Hank, Monroe county, Virginia, May 8.

The machine for liming consists, in part, of a frame made in the manner of a bedstead, having cords stretched across as in the corded kind. Upon this net work the skins in the liming vat lie, and when they are to be aired they are raised by means of a windlass and pulley attached to a framing over the vat. Ropes descend and are hooked to staples in each corner of the liming frame for this purpose.

The handling apparatus is also supported on a frame over the vat. The skins are all attached to each other by ropes at their ends, and a part of the handling apparatus consists of a roller, turned by a crank, which roller extends across the vat, and is of sufficient length to receive the skins. Ropes from the upper skin are attached to the roller, and on turning this the continued sheet of skins is rolled upon it, the ooze falling back into the vat. There are some contrivances about this apparatus which we have not noticed, but what we have said exhibits its principal features.

5. For a *Self-regulating Horizontal Wind Mill;* Jeremiah Coleman, Vincennes, Knox county, Indiana, May 4.

We just now dismissed one horizontal wind mill because its physiognomy was not sufficiently expressive, or we were not sufficiently skilled in the science to enable us to judge of its disposition; and we are again called to encounter a wind mill which will also prove too much for us, or too little for the patentee. We, however, can give a pretty clear idea of its construction, and know that we have readers who will be thereby enabled to trace its operation, whatever it may be.

There is the usual vertical shaft of the horizontal wind mill, from the upper end of which four arms project in order to support the upper ends of the sails, or wings, and below them four others to sustain their lower ends. The sails, or wings, are made like doors, and, like them, turn, or are hinged upon one edge. A pivot passes from each of these wings into one of the upper, and another into one of the lower arms, and upon these they swing freely without any check or stop. The upper arms, however, are made several inches longer than the lower ones, so that the wings are not hung vertically, but droop, or swag, and there is a contrivance for increasing this drooping when desired; the lower end of the wing being hung on a sliding piece. This part of the contrivance the inventor calls "GRAVITY UPON WIND."

The running gear is to be the same as in any other horizontal wind mill.

The patentee says that "the above described mill is safe with almost any sized wings, as each wing, during a storm, stands with its thin edge to the wind."

The foregoing are all the data, and now let the machinists *solve the* problem of the action of this machine, and ascertain its comparative value.

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6. For an improvement in the *Grist Mill;* Oliver N. May, Hancock, Delaware county, New York, May 5.

This is another portable grist mill, differing from those which have preceded it in some points of arrangement which are claimed as new. The spindle is kept from rising in a manner like that of some which we have described as having on the lower end a projecting button or fillet with a collar or strap above it; the one now before us is more complex than those alluded to, but the end is attained in a similar way. Instead of weighting the runner directly, we are told that weight may be added to it by "casting the spindle large," and the doing this forms one of the claims. The principal novelty in this mill consists in what is called "a vibrating bolt." This is a frame which may be eighteen inches wide, five high, and of any convenient length; the bottom and sides of it are to be covered with bolting cloth, and the top with any kind of light cloth. This bolter receives the flour from the spout, is placed in an inclined position, and has a vibratory motion given to it from the action of the driving machinery of the mill.

7. For an *Artificial Sedlitz, or Rochelle Water;* Joseph Boston, city of New York, May 5.

This improved mineral water, or *aerated saline aperient*, the patentee calls "imitation Sedlitz or Rochelle water." To prepare it, twenty pounds of carbonate of soda are dissolved in twenty gallons of boiling water, and to this solution is added, in small repeated doses, to avoid too powerful an effervescence, an equal weight of bitartrate of potass (cream of tartar.) After this liquor has cooled it is to be put into a soda water fountain, and impregnated with carbonic acid. This, when taken with any of the usual sirops, becomes an agreeable and active aperient.

Seventeen pounds of common Rochelle salts, and three of the soda dissolved in ten gallons of water, will, it is observed, produce a liquid essentially similar; but when thus made it is more expensive than the first process.

The claim is to the discovery that the foregoing mixtures impregnated with carbonic acid, form a grateful and useful aperient.

To discover, has been defined to be the finding of that which was before unknown; thus viewed, the foregoing fact could not have been discovered by the patentee, as it was before well known. The only thing which could be legitimately claimed in the foregoing process, would be the impregnating of the aperient solution with carbonic acid by the same means which are employed for impregnating the so called soda water. The sedlitz powders may be made by mixing together one drachm of Rochelle salt, and fifteen grains of carbonate of soda, both in powder; and having in another paper twenty grains of tartaric acid. When these are dissolved in water contained in separate tumblers, you obtain something very much like the foregoing mixture impregnated with carbonic acid, and thousands of persons have *discovered* that it is a grateful and useful aperient.

Would not the economy of the process prescribed by the patentee be promoted by collecting the carbonic acid disengaged in making the mixture, and afterwards impregnating the fluid with it. This could certainly be effected by an addition to the apparatus, which might be made at a very small expense.

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8. For an improvement in musical instruments, denominated the *Seraphine, or Harmonicon Organ;* Lewis Zwahlen, city of New York, May 5.

This patent is taken for adding to organ pipes the vibrating springs from which the tones in the common seraphine are derived. A plate of brass, or other metal, is to be attached laterally to one extremity of the pipe, which is then to be fixed in the wind chest in the ordinary way. More than the usual degree of compass, volume, and softness, we are informed, can be thus attained. The patentee observes that the principle resembles that of the reed in the clarionet. Although we have seen this vibrating spring applied in wind instruments, played upon by means of keys, we are not aware that it has been used on

organ pipes, and cannot doubt that it may add to the instrument a very good and pleasing stop.

9. For a *Plough;* Joseph Dudley, Fleming county, Kentucky, May 8.

The share and mould board of this plough are in one piece; the instrument is to be made of wrought iron, and put together with nuts, screws, &c. as directed, and when this is done it is then a patent plough.

10. For a *Cooking Stove and Fire-Place;* Edward Potter, Providence, Rhode Island, May 8.

A cooking stove, having a grate for burning coal, a blower, a hole in the plate above the fire, and some of the other ordinary appendages of such affairs, is described, and the patentee then says that "I claim as my invention the before described cooking stove and fire place." We think that the invention must in this instance be microscopic, as we are unable to discover it with spectacles No. 14.

11. For a *Board Shearing Machine;* Simon Willard, Cincinnati, Ohio, May 9.

This machine is intended for cutting laths out of boards, and also for cutting strips and splits for a variety of purposes. Narrow flooring boards, sixteen feet in length, are mentioned as intended to be cut by it.

An iron shaft of the required length is to be extended across a strong frame; for laths, this shaft need not, altogether, exceed six feet in length. On its ends there are to be fly wheels, and on its middle a whirl for driving it. Two cranks work a vibrating cutter, or long knife, up and down between cheeks by which it is steadied. The board, or other article to be cut, is to be fed beneath the knife, where it is supported on a fixed beam.

The claim is to "the combination of the machinery and shears, with the vibrating cutter, to the new and useful purpose of cutting boards, plank, or slabs, lengthwise, into plasterer's laths, narrow flooring, and weaving strips, or splints." The patentee adds that he claims only what he has invented that is new and useful. It is certainly right for an inventor to claim no more than what is new and useful, but it is for him to tell what he considers to be so; although such a declaration would not be a salvo in case of claiming too much, or include any thing described, that is not claimed.

12. For a *Soda Fountain;* Andrew Kirkpatrick and James Fraley, Urbanna, Champaign county, Ohio, May 9.

This new edition of the (so called) soda fountain is, like the former ones, to have two reservoirs, one to contain a solution of carbonate of soda, the other an acid solution, and a double cock for uniting the two in drawing. There are to be smaller reservoirs for containing sirops, with cocks to draw them off; cavities are also provided to

contain ice, and a casing around the whole for receiving powdered charcoal, to preserve the temperature.

If the first patent of this kind was good for any thing, it has been violated by all those since taken, as its principal feature, the double cock, distinguishes the whole of them. This, we think, is the seventh patent, within a short period, for what is essentially the same thing.

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13. For a *Thrashing Machine;* Samuel Kable, Beaver creek, Green county, Ohio, May 10.

This thrashing machine is to be made with the ordinary cylinder and concave, and to be fed in the usual way, but the straw and grain are to be delivered from it on to a riddle, or screen, somewhat inclined, and kept vibrating by motion communicated to it from other parts of the machine. The patent is taken for this addition, which is, of course, intended to separate the grain from the straw. There are several thrashing machines which have appended to them an apparatus for separating the straw and grain by means of a riddle, and some of them are also furnished with fans for cleaning the grain: the present patent is, of course, confined to the particular arrangement adopted by the patentee.

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14. For a *Gas Lamp;* Solomon Andrews, Perth Amboy, Middlesex county, New Jersey, May 10.

(The specification will be shortly published.)

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15. For a machine for *Hulling, Cleaning, and Polishing Rice;* Joseph Beach, and Sylvester Starr, Middletown, Middlesex county, Connecticut, May 10.

In a tub, which may be about two feet in diameter, and four feet in height, nine polygonal rollers of wood are made to revolve vertically, one in the centre, and eight around this one. The centre roller may be made octagonal, and ten inches in diameter; the eight which surround it may be five inches and three-fourths in diameter, with the same, or a greater, or less, number of sides than the centre one. These rollers have gudgeons which work below in the bottom of the tub, and above in a cast iron frame fixed to the top of it. A cog wheel upon the centre roller meshes into smaller wheels on the small rollers, and when the centre roller is made to revolve it gives motion to the whole.

The rice is fed into the tub, and is to be hulled and polished by its friction against the rollers, and among its own grains. There is a gate at the bottom to allow the hulled rice to escape. The claim is to the above described combination of the various parts of the machine, so as to produce the intended effect of hulling and polishing the rice.

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16. For a *Machine for Shelling Corn;* William Gee, Templeton, Prince George county, Virginia, May 10.

A wooden wheel is made to revolve vertically, like a grindstone, but its shaft has on it a pinion upon which a toothed wheel acts in order to accelerate its motion. One side of the wheel is set with wrought iron teeth, and the ears of corn are borne against these by a spring board. The plank to which the working parts are affixed, forms an inclined plane down which the cobs descend as the corn is shelled.

The claims put in are to the manner of making the frame, and to the setting of wrought iron teeth into the face of the wooden wheel. This is what some persons might be inclined to call a "wooden contrivance," as machines acting upon the same principle precisely, have been long since made of cast iron, and if the patentee will do as we once did, and send to the Richmond foundry, in his own state, he may purchase a machine very much like his own, but better, because it is made of cast iron.

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17. For a machine for *Making Cooper's Rivets* from iron, copper, or other metal; George W. Sowle, New Bedford, Bristol county, Massachusetts, May 11.

The heated metal which is to be made into rivets is passed between two iron rollers, grooved so as to reduce it to the size of the shank of the rivets, and the metal is received by an apparatus which cuts off and heads it. From the nature of the machinery its description would require drawings to make it understood. The claim is to every part of the machine with the exception of the grooved rollers. The description, as given, is obscure, and the drawings themselves are not well executed.

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18. For *Paper for covering Buildings;* Frederick A. Taft, Dedham, Norfolk county, Massachusetts, May 11.

Paper is to be made by taking finely ground coal and sulphur, and mixing it intimately with the pulp, after which the sheets are to be formed in the usual way. After the paper has been dried it is to be passed between heated rollers, which will melt the sulphur, and render the paper impervious to water; other materials are to be sometimes employed for the same purpose, and the paper, instead of being rolled, may be pressed between heated plates, or put into an oven. The proportionate quantities of the materials employed, may be one part, in weight, of fibrous stock, two and a half of brimstone, and two of coal. Salt and lime are sometimes added to render the whole less combustible.

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19. For a *Machine for Crimping Boots;* Silas Witherby, Essex, Chittenden county, Vermont, May 12.

A screw is made to force a follower down between the cheeks of a press: upon the follower are two pieces of plank which are forced down upon the crimp. The claim is to "the application of the screw;" and the whole description does not occupy double the space of our notice of it.

20. For a "*Safety Carriage;*" Robert Beale, city of Washington, District of Columbia, May 12.

(See specification.)

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21. For an improvement in *Napping Hats;* Joseph Dort, jr., William Wells, and Daniel Olmstead, Buffalo, Erie county, New York, May 12.

There is a tub of about three feet six inches in diameter, and sixteen inches in height; the bottom of this is to be covered with suitable cloth, and it is furnished with a cover fitting it steam tight. A vertical shaft rises in the centre of this tub and passes through the cover. This shaft may be made to revolve by means of a crank and bevelled wheels. From the shaft proceed arms which carry four conical rollers, in the form of hat bodies, that revolve on the bottom of the tub. The bodies to be napped, having the napping previously stuck on, are stretched over these cones, and over them suitable covers are then strained. When they are fixed in their places, the tub is covered, and steam admitted into it through tubes, the revolution of the cones being kept up during the scalding. More than one body may be placed upon a cone at the same time.

There is no claim made; the whole apparatus, it is presumed, being considered as new in its application.

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22. For a *Cooking Stove;* Horace Bartlett, Bridgeport, Fairfield county, Connecticut, May 12.

We apprehend, from the construction of this stove, that wood is to be the fuel burnt in it, as it is not furnished with any thing in the nature of a grate, but has a fire-place like that of the common kitchen stove. Above this fire-place is an oven furnished with folding doors, and having ledges upon which to rest tin plates for the baking of bread, &c. This, it appears, is an essential feature in the invention, as the patentee says, "I claim as new the construction of the oven so as to bake eight loaves of bread at one time, placing them in two or three layers deep. To accomplish this, and claim as new, I use a sheet of tin, which, being a non-conductor of heat, and raised from the bottom of the oven, prevent the bottom loaves from burning," &c.

One part of this discovery is certainly new; namely, that tin is a non-conductor of heat; but of the remainder we cannot say so much; the practice of baking loaves and other articles on tin, or sheet iron, is rather antiquated, and the placing them in tiers is not a thing of yesterday. How, and where, holes are left for pots, kettles, and frying pans, we shall not at present attempt to tell, as these parts resemble those for the same purpose in other stoves. Among the claims, however, there is one for "cramping the blaze into small tubes, by which the heat is conveyed off with much greater strength." The smoke escapes through semicircular openings on each side of the oven; and these flues are the small tubes into which the flame is

"cramped." The sides of the oven form the flat sides of these flues, and are heated by the flame passing through them.

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23. For a *Machine for Forming Hat Bodies;* Seth Graham, Fayette, Kennebeck county, Maine, May 15.

About three years ago, the patents obtained for forming hat bodies were very numerous; and since that time the processes of napping, stiffening, dying, and washing, have been the subject of various application. The forming machinery, for which the patent before us has been granted, does not differ, in the general principle of its action, from several others. The wool is to be delivered from a carding machine in a continued fleece, and received upon two conical formers revolving against a double conical roller, the fleece, or sheet, being cut along the middle as it winds upon the bases of the conical former.

To give the required crossing direction to the fibres of the wool, the apparatus carrying the rollers, receives a vibratory motion in a way differing from that in which the same end has been attained in other machines. To describe the mode of doing this would require more space than we can conveniently devote to it. The specification ends with the words, "the machine above described I claim as the first and sole inventor." As most of the parts are used in the same way, and for the same purpose, as in other machines, this claim appears to be rather too broad.

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24. For a *Machine for mixing Clay and Mortar* for making bricks, and other purposes; David Phillips, Natchez, Adams county, Mississippi, and John Drummond, Whitestown, Oneida county, New York, May 15.

A wheel is made to revolve in a circular trough, in the ordinary way, and may be four or five feet in diameter, and about one foot thick. Its periphery is covered with plates of iron cast in segments and fastened around it. These segments form circular cutters, or knives, all round the wheel, the blades being about eight inches wide, and having a space of an inch and a half between them. To prevent the clogging of these spaces a comb-like cleaner, supported on a piece of timber attached to the shaft, scrapes between them, while water from a reservoir, also fixed on the shaft, drips upon the clay. The claim is to the before described machine, and particularly to the mixing wheel with blades, and the manner of cleaning them.

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25. For *Coating Lead Pipes with Tin;* Thomas Ewbank, city of New York, May 16.

(See specification.)

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26. For *Preparing the Fillers for Cigars* by a machine called the Filler Breaker; Joseph Maffet, Lancaster, Lancaster county, Pennsylvania, May 16.

This machinery is too complex to be accurately described without

a drawing; but the object of it is to roll tobacco for the filling of cigars. For this purpose there is an endless revolving apron, made of leather, or other suitable material, upon which the tobacco to be rolled is spread. This apron passes, by its revolution, under a piece of sheet iron, called the guide, and in doing so the tobacco is rolled, and when there is enough to form a filler, it is broken off by hand, and the operation continued. The claim is to "the before described machine."

We think that this instrument might be simplified, and considerably altered in its combinations. Would it then be "the before described machine."

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27. For an improvement in *Andirons;* William Wilson, Greenfield, Franklin county, Massachusetts, May 16.

In this andiron, the front, or upright part, and the bar and back foot part, are made separate. They are to be put together by means of a wedge-formed dovetail on the front end of the bar, which falls into a corresponding recess formed by projecting cheeks on the back of the upright part.

The advantages of this mode of forming are said to be facility of packing; more easy manufacturing; increased strength, and economy in use, especially when made of cast iron, as one part can be renewed when the other is broken, or burnt out.

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28. For an improvement in the *Paddle Wheel* for steam boats, &c.; John Sheffield and Jonas Ingraham, Buffalo, Erie county, New York, May 17.

We see not the slightest variation in principle, and very little in arrangement, between this paddle wheel and such as have been repeatedly proposed, patented, and essayed, both here and in Europe. The object is to preserve the paddles in a vertical position, and the means of effecting this is the employment of a wheel eccentric to the shaft of the paddle wheel, pins, or cranks, from which act upon the buckets, that are connected also to the rim of the main wheel.

The specification describes the whole very clearly, without, however, taking the slightest notice of the fact that similar wheels have been heretofore made, or furnishing any thing in the form of a claim. A person ignorant upon the subject, and reading this specification, would at once conclude that the whole thing was a new contribution from the arcanum of mechanical science. Such wheels, however, have had fair and long continued trials, but have not been found in any respect superior to the common paddle wheel, whilst they are much more expensive, increase the friction greatly, and, from their complexity, are very liable to derangement.

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29. For an improvement in *Fire Arms;* Joseph W. Plummer, and John Clark, Wayne, Jefferson county, Ohio, May 17.

There is to be a magazine in the breech of the gun, which is to contain powder; and, when the gun is to be loaded, a portion of this

powder is to be conveyed, by an apparatus contrived for the purpose, into the barrel. There is an opening in the under side of the barrel, just above the charge, which is closed by a screw, with a crank handle adapted to it. The trigger guard is made to slide back, and to carry with it what is called the charger, which is an iron chamber fitting on the under side of the barrel; when this is drawn back, it receives powder from the breech, and when pushed forward carries it under the hole in the barrel, which has to be turned over to allow the powder to fall in. The ball is afterwards to be inserted, and the screw turned into its place.

There is also a funnel shaped magazine for priming powder, it being made self-priming by the action of the cock.

These parts constitute the *improvements*, which term, however, we think a misnomer. We had supposed that magazines for priming powder were exploded by workmen in consequence of their liability to explode themselves after a gun has been sometime in use. The percussion powder used in such chambers corrodes the gun, whilst the fulminating mercury employed in the percussion caps is free from that objection. Should the charged mine, in the breech of this gun, be accidentally sprung, it would make sad havoc. The loading near the breech at a hole closed by a screw is an old contrivance, and the form in which it is here presented, although it may be new, does not appear to be an improved one. These are a few of the objections to the said contrivance which present themselves to us, the remainder we will not offer, being unwilling to lengthen the catalogue, and shall be most happy to withdraw these, when we see good cause for so doing.

The claim is to the "method of loading, priming, and firing guns, rifles, pistols, and all kinds of fire arms, by means of the magazine, sliding charger, and percussion tube."

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30. For an improvement in *Making Rifles;* Joseph W. Plummer, and John Clark, Wayne, Jefferson county, Ohio, May 17.

This patent is taken for a tool for rifling barrels, and we regret to say that we do not think more favourably of the method of fluting, than we do of the construction of fire arms, patented by the same gentlemen.

Three or more pins, or cutters, are to be made of cast steel, with projecting threads on them having the twist intended to be given to the rifle. These pins are to follow each other successively, as they are to be driven through the smooth bored barrel by a hammer and punch.

We should greatly prefer the rifling machines usually employed, and are much mistaken if the judgment of workmen in general will not coincide with ours. These pins will undoubtedly operate, but not more rapidly than the tools already known, and should one of the cutting threads chip in driving forward, others would be likely to share a similar fate in driving it back.

The claim is to the rifling of guns by means of such pins.

31. For an improvement in the *Striking Clock;* James Bogardus, city of New York, May 18.

This improvement in the striking clock consists, in part, in the winding up of the two barrels at the same time; for this purpose they may both be placed on the same arbor, and they are then to be so connected that when winding they shall be acted upon together, but when discharging they shall act independently of each other. After the mode of doing this has been described, we are informed that "the barrels may be placed on separate arbors as in common clocks, if desirable," and in this case nothing is said of connecting them so as to wind together, although the winding together is one of the two points claimed; the other is "the method of arranging the stop, by which the machine is simplified." This part is very indistinctly described, and the drawing lends no great aid to the description.

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32. For an improvement in the *Door Lock;* James Kyle, city of New York, May 18.

The parts of this lock upon which the patentee rests his claim cannot be accurately described without a drawing, although a general idea of its mode of action may be given. The bolt is shot forward by a spiral spring acting against it, and it is intended to be used as a spring door lock, the bolt being moved by turning a handle in the usual way. The lever on the handle, works in a mortise made entirely through the bolt, which mortise is sufficiently long to allow the bolt to be drawn back, and clear the catch, or box.

Behind the bolt there is a number of flat, thin levers, made of plates of metal, and working on a pin. Each of these has a projecting piece on its end which falls into a notch in the bolt, retaining it in its position. The catch pieces upon these levers differ in length, and they require, therefore, to be raised in different degrees in order to disengage the bolt and allow it to act. The key has on it a number of projecting pieces, or cams, corresponding with the number of levers, each of which is to act upon its proper lever and raise it as a latch is raised. The projecting pieces on the key are formed of thin metallic plates like that of the lever latches; these slide over the shank of the key, and are secured by a nut on its end; this is done for the purpose of giving to them an arrangement corresponding with that of the levers, which all work upon one common fulcrum, and are susceptible, therefore, of an almost infinite variety of changes, the cams also can be so changed as to act with them.

The claim is to the whole of the before described lock, with the exception of the stock, and the spiral spring under the bolt.

Although the principle of a number of levers, or tumbles, falling into notches in a bolt, and the raising them in different degrees by means of the key, is not new, the arrangements by which this is effected in the present instance, we think sufficiently so to become the foundation of a valid claim.

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33. For a machine for *Making Brush Handles,* Rake Han-

dles, &c. Evans Tuck, Harrisburg, Dauphin county, Pennsylvania, May 18.

The timber is to be rounded by a tubular plane, equal in length to the handle to be formed. This plane is made of four pieces of stuff, which, when fixed together by suitable bands, form the tube through which the timber is to be forced. Upon each section of the plane there are eight irons, the first of which merely takes the angles off the square stuff, whilst the whole of them, acting in succession, reduce it to a round stick.

This plane is placed at the end of a trough in which the square stick is laid, having behind it a follower or rod, which is forced up by any adequate power, and drives the stick entirely through the hollow plane. The trough may be so high as to contain a considerable number of such sticks, which fall successively into their places as the follower is withdrawn. The patentee thinks that by the application of sufficient power, a stick may be rounded every second.

The power which will suffice to force the stick against thirty-two irons at once must be considerable, and a motion so rapid as that spoken of would create no small degree of heat; too much, we think, for the temper of the irons. The most formidable objection, however, to this machine, we should apprehend, would be its liability to choak, and the difficulty of clearing it out; but it is to be presumed that the patentee has satisfied himself on this point. We have seen sticks and handles of the kind named turned by means of a very simple apparatus; not so rapidly indeed as above indicated, but at the rate, we believe, of at least one in a minute.

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34. For an improved *Winnowing Machine;* James Ruple, Washington, Washington county, Pennsylvania, May 19.

The parts of this machine are generally the same with that of others for winnowing and cleaning grain, and we should think it time spent to little purpose to attempt to point out the particular differences; we shall therefore content ourselves, and, we presume, meet the approval of most of our readers, by giving the claim.

"What I claim as new, and of my own invention or discovery, is the formation of the screen, and the manner of shaking and using it; and the cant boards under the shoe to prevent the grain from scattering."

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35. For a *Machine for Dipping Candles;* John Aborn, city of Trenton, New Jersey, May 19.

A vat is prepared for holding the tallow into which the wicks are to be dipped; it may be made of copper, and of such dimensions as are required in the operation; it is surrounded by a tight wooden box, between which and the vat, steam from a boiler is to circulate, for the purpose of heating it. A reservoir for supplying the vat is constructed, and heated upon similar principles. The main part of the apparatus, however, consists of a frame of any convenient length, and wide enough between its sides to admit the sticks upon which

the candles are arranged, and the carriages which support them; the dipping vat stands at one end of this frame. A double rail-way, one placed above the other, extends along the frame; and by means of a windlass, the connected carriages, each supporting a row of sticks, are advanced towards the vat, when they arrive there, the candles are dipped, and placed upon the lower rail-way, and carried back, to be again returned. There is a contrivance for weighing the candles, which consists of a long lever extending from front to back, along the upper part of the frame, and supported on fulcra like a scale beam; several other matters of detail are also noticed by the patentee, as a wicking frame, &c.; in point of detail, however, the description is defective, leaving too much to be re-invented by any one who should attempt to construct the machine with no other aid than that which is afforded by the specification.

The claim is to the before described machine, and particularly to the rail-ways, the balance beam, the carriages, the sliding frames, the slides with catches, the wicking frame, and the lever for hoisting and weighing.

The objection to this form of claim is, that after including the whole machine, it particularizes certain individual parts, which, if the whole arrangement is new, is altogether unnecessary; whilst if the whole is not new, the general claim would endanger the validity of the patent.

Specifications of American Patents.

Specification of a patent for Coating Lead Pipes with Tin. Granted to Thomas Ewbank, *city of New York, May* 18, 1832.

To all whom it may concern, be it known, that I, Thomas Ewbank, of the city of New York, have invented a mode of coating lead pipes with tin, in a more effectual manner than has been heretofore done, and by which the danger attending the use of such pipes for the conveyance of water, and other liquids, is obviated, whilst their cost is but little enhanced; and that the following is a full and exact description of my said invention.

I take the lead pipes, *after they have been drawn to the required size*, and I coat them with tin, either on both sides, or on the inside only, as may be desired. To do this I prepare a bath of melted tin, in a vessel of a suitable form and size, which may vary according to the size of the pipe to be tinned. I regulate the heat of this bath, so that the tin shall continue in a fused state, without becoming sufficiently heated to melt the lead. This may be ascertained either by the use of a thermometer, or by testing it by a piece of lead, or by such a mixture of lead and tin as will fuse at a given temperature: with a little experience, however, a workman will not find any difficulty in accomplishing this object without such aids. When the pipe is to be tinned on the inside only, I cover the outside with lamp-black and size, or with any other article which will prevent the ac-

tion of the tin upon it; I then blow powdered rosin into the pipe. When it is to be tinned on both sides, the rosin is to be blown, or otherwise passed into the pipe, and the outside also is to be sprinkled with it, and it is then ready for the process.

The melted tin should be kept covered with rosin, fat, or other suitable article, to prevent its oxidation, and to aid in the tinning. All that is necessary is then to pass the pipe through the melted tin, which, when the pieces are not of considerable length, may be easily managed by hand; or when of considerable length and weight, a rope and pulley, or any other suitable mechanical contrivance which the workman may prefer, may be resorted to.

I am aware that the coating of lead pipes with tin, simply, is not new, the same having been heretofore done, but in a manner less perfect than that which I have just described. The lead has been tinned in sheets, and afterwards made into pipes, or the pipes have been made and tinned, and afterwards drawn to the intended size. By neither of these processes, however, is the intended security obtained with the same certainty as by my process of tinning the pipes *after* they are otherwise finished. The coating of tin is thus rendered more perfect, and those fissures are avoided which the former processes can scarcely fail to produce.

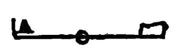
I do not, therefore, claim as my invention the mere tinning of pipes made out of lead, but what I do claim is the tinning such pipes after they have been drawn to the proper size, as is hereinbefore set forth.

THOMAS EWBANK.

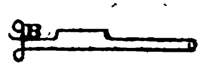
Specification of a patent for a mode of detaching horses from a carriage, either when running away, or whenever it may be desirable to effect that object, rapidly. Granted to ROBERT BEALE, *city of Washington, District of Columbia, May* 12, 1832.

Be it known, that I, Robert Beale, of the city of Washington, in the District of Columbia, have made an improvement in carriages, by which the horses may be suddenly disengaged when running away, or whenever required to be detached from the carriage quickly; called the safety carriage; which is described as follows.

The swingletree is attached to the cross bar by an iron fixture called a jointed clasp, formed as in the annexed figure; the knee part, marked A, resting against the back of the cross bar. This jointed clasp is



held up against the underside of the cross bar by an iron shutter, or hinged clasp, formed thus, turning on a joint, or hinge, secured to the underside of the cross bar. To the end of the hinged clasp is attached an iron rod,



or bolt, B, with an eye at its end. This rod, or bolt, passes through an opening in the cross bar, and has an iron spring key inserted through the eye, resting on the upper side of the bar, which secures

the jointed clasp from dropping; or the rod may be fixed permanently to the cross bar, projecting far enough below it to pass through a slot or mortise in the end of the hinged clasp, with a spring key inserted through the end of the rod, or bolt, to prevent the hinged clasp falling. To the end of the spring key is attached a cord which leads inside of the carriage, where it hangs loosely. Should the horses take fright, and become unmanageable, the cord is then to be pulled suddenly, which will draw the spring key from the eye of the rod, or bolt, let the hinged clasp fall, and with it the jointed clasp attached to the swingletree, and will disengage the horse from the carriage.

The tugs are open in front, thus, to allow the breeching to slip off freely. This breeching is made from a single strap of leather, with rings sewed to the ends, to hook over the tugs.

The shutter, or hinged clasp, may have its end turned up at right angles, and formed like a catch, or hook, and secured by a spring, fastened to the side of the cross bar, the cords being attached to the end of the spring. The shutter may, indeed, be held up in a great variety of modes, but the before described are sufficient to show the principles of my invention.

When it is desired to retain the swingletree, and let the horse go off with traces only, then a hinged clasp must be put on each end of the swingletree, with the jointed clasps secured to the ends of the traces, and the cords attached to the spring keys run through pulleys and are joined to the cord which leads inside of the carriage.

In the two-horse carriage, the shutters, on hinged clasps, are hung on the under side of the wheppletree, and the cords attached to the spring keys run along on the top of the wheppletree in a straight line, then pass around pulleys, and are joined to the single cord which leads inside, or outside, of the carriage. The pulleys are to cause the cords to run freely, and to draw the spring keys, or pins, from the eyes of the rods, or bolts, in a straight line.

An iron tube, with a flanch on one end, is fastened to the end of the pole. Over this is put a thimble, having a ring on each side, to which the breast straps are attached. This thimble slips off the end of the pole, when the horses are disengaged.

The mode of detaching the horses from the two-horse carriage is similar to that described for a single horse carriage.

In a four-horse carriage the leaders are disengaged from the pole in the same manner, by a jointed clasp, hinged clasp, spring key, and cord, as described for a two-horse carriage. The jointed clasp may be held up against the cross bar by a pin inserted through the jointed clasp into the hind part of the cross bar, to which pin the cord is attached.

The jointed clasp may also be secured by a spring fastened on the hind part of the cross bar, the cord being attached to the end of the spring. Springs, or friction levers, are secured to the carriage, and brought in contact with the hub in order to decrease the motion of the carriage when the horses are liberated, or before they are liberated.

This invention may be applied to field artillery, and it will enable the men to limber or unlimber the gun in less than half a minute. It may also be applied to wagons of every description, to ploughs, and harrows, and all kinds of agricultural implements drawn by horses, when required to be taken in haste from the carriage to feed, &c.

A forked piece of iron is suspended over the hound and front axletree to prevent its turning on the body bolt.

What I claim as my invention, and which I wish to secure by *letters patent*, is the before described apparatus for suddenly disengaging horses from carriages.

For a further illustration of my invention I would refer to the models and drawings of the same deposited in the patent office.

ROBERT BEALE.

ENGLISH PATENTS.

Patent granted to GEORGE LOWE, *for an improvement in the manufacture of Gas for Illumination.*

Mr. Lowe may lay claim, and justly, not to one only, but to a series of four inventions, each ingenious and useful, and in combination very valuable.

His first object is to purify the gas—his second, to evolve a greater quantity of a superior quality from the very same proportion of material, and in the very same period of time—his third object, to show the means of securing his first without new efforts—and his fourth is very similarly connected with the second, and includes the application of the whole apparatus to the attainment of the great end.

His stove is of three retorts, the section of each being a parabola. The furnace is as usual; but if, mechanically, his invention be ingenious, it is also chemically profound. He proposes to introduce atmospheric air, heated to 700 degrees of Fahrenheit, or even hotter still, either above, or over the surface of the fuel in the retorts, to bring it in contact with the sulphuretted hydrogen gas cooled from the coking coals in the retort during the process of their decomposition, and with the other gaseous and vaporous exhalations from lime-dreg water, ammoniacal liquor, and other fluids introduced under the furnace. By the combination of the atmospheric air (heated as we have said) with these gaseous evaporations, and their consequent ignition, he produces a sulphuric acid, which, mixing with the pure gas intended for illumination, as it passes the mains, &c. purifies it of those deleterious matters which have hitherto so lessened its brilliancy, equability, and utility. To effect these purposes he has a vessel with lime-dreg water, and one with ammoniacal liquor under the furnace; he has a flue or passage beneath, or at the side of the furnace for the entrance of the atmospheric air, affording the

means of heating it to the high temperature we have already stated, and a series of passages from this flue, or tube, into the furnace above the fuel, and over the surface of the burning mass in the retorts. A current of steam is introduced before the gas is conducted to the condenser, and affords, of course, a powerful aid to the purifying agency we have already described.

The second part of the invention consists in having retorts of exactly double the length of those in common use, and capable of being opened at both ends. Suppose, then, that the charge is intended to be one of eight hours, as usual: instead of putting in at once the whole quantity of coal, or coal tar, from which the gas is to be educed, Mr. Lowe would open one end of his retort, and put in exactly half the quantity; then at the end of four hours he would open the other extremity of his retort, and admit the other half. At the end of the next four hours, he would draw half the charge, and this process he would repeat at each end of the retort, alternately every four hours for a charge of eight hours, and every three hours for a charge of six hours. The advantage of this process is, that while every particle of the coal is allowed the same time, and the same means as are given by the common method for its decomposition, the gas evolved from the fresh coal mixes, and is combined with the riper gas from that portion which has had eight hours of burning time, that is, (for we could not be figurative,) eight hours of burning, to breathe out the gas. The coke, after this gas has exuded from it, is submitted to another process, by which all that remains is obtained: and by the interposition of steam, sulphuric or muriatic acid, and the carbonate of potash, the former applied as before described, the latter introduced over the coke in the retort, or the fuel in the furnace, is purified as at first.

The fourth invention is the retort, of its new length and shape; the furnace with its atmospheric air flues, and its troughs of ammoniacal liquor and lime-dreg water; the condensers, with their steam cocks, and inner plates and pipes, and all the apparatus by which the effects we have imperfectly described, are admirably brought about. The gas is purer, in larger quantities, and is produced in the same time, and at a less expense of labour and material, by the inventions of Mr. Lowe; and it is exceedingly probable that the whole, or the greater part, of his improvements will be introduced to general use in all gas works.

[*Rep. Pat. Inv.*

Specification of the patent granted to Moses Teague, *Iron Master, for an improvement in the making and smelting Pig Iron. Dated January* 17, 1831.

To all to whom these presents shall come, &c. &c.—Now know ye, that in compliance with the said proviso, I, the said Moses Teague, do hereby declare, that the nature of my said invention,

and the manner in which the same is to be performed, is particularly described and ascertained by the following description thereof, reference being had to the drawing hereunto annexed, and to the figures and letters marked thereon, (that is to say:)—

This improvement consists in making use of, or employing the flame and heat (heretofore discharged into the open air) from the tops or tunnel heads of blast furnaces or cupolas, used for the making and smelting of pig iron, by means whereof the said flame and heat is made to act upon the ores, mines, and minerals, about to be smelted, previous to the same being deposited into the interior of the furnace or cupola. The material is thereby acted upon with additional heat, which would otherwise pass away without producing effect, and the preparation for smelting so much forwarded as to require considerably less fuel, blast, and time in the operation. The method of applying the same is by diverting the flame and heat (usually passing out of blast furnaces or cupolas, into the open air) and causing the same to pass in, upon, or through, one or more ovens, stoves, buildings, or erections, to be fixed in, or upon, or near to, or adjoining, the tops or tunnel heads of the said furnaces or cupolas; which said ovens, stoves, &c. &c. are made to contain certain portions, quantities, or charges, of the materials intended to be smelted, which, being previously deposited therein, the heat and flame so diverted are made to act thereon. The said flame and heat diverted from its usual course, and driven, or discharged into, or through the said ovens, stoves, &c. &c. by partially contracting, or stopping up altogether, the tops or tunnel heads of the said blast, furnaces, or cupolas, either permanently with brick, mason's work, or any other mode, or by one or more moveable dampers, doors, or valves, to be fixed on, in, or upon them, or the said ovens, stoves, &c. &c. By this means the flame and heat is diverted, and caused to pass into, or through, the ovens, or stoves, which have one or more chimnies, or flues attached thereto, in order to carry off the superfluous heat, flame and sulphur.

The shape, size, and number of the said ovens, stoves, or chambers for containing the ore, mine, or mineral, might be varied according to the size of the furnace, or cupola, and the quantity of materials used in each load or charge, but the more surface can be obtained (provided a sufficient quantity of heat and flame can be brought to act thereon,) the better, as the materials to be smelted can be more thinly spread, and, consequently, present a greater surface to be acted upon by the said heat and flame.*

* In the Repertory of Patent Inventions, for July last, from which the above is abstracted, there are drawings exhibiting various modes in which the patentee intends to carry his plan into effect, to which we must refer those interested.

Patent to W. Hale, *Machinist, for improvements in machinery for Propelling Vessels, granted October* 13, 1831.

The improvements in propelling proposed by Mr. Hale, consist in driving water forcibly out at the stern of the vessel under the water line, by means of a rotatory apparatus, somewhat similar to the rotatory blowing and winnowing machines.

In the 5th volume of the present series of the Register of Arts, p. 67, we have given a description of a patented invention of Mr. William Hale for raising or forcing water for propelling vessels, and the present patent has been taken out for a modification of the same method, therefore we refer our readers to the former description to obtain a general idea of the plan.

In his second patent Mr. Hale makes the exterior casing of the paddle box to recede from the centre spirally, constituting a curve whose distance from the centre of motion at its outer extremity exceeds the distance at its inner extremity by the space or opening made for the escape of the water from the box. The water is admitted into the box through openings near the centre, in the manner usually adopted for the supply of air to the blowing machines. The propeller, or vane, which puts the water in motion through the medium of a steam engine, or other first mover, consists of a single lever receding spirally from the axis, or centre of motion. The motion of the vane is in the direction to cause the water within the box to recede from the centre, and escape finally in a direction which is a tangent to the curve; or its motion is towards its back, or that part farthest from the centre. The patentee does not, however, confine himself to the spirally formed vane, but proposes several other modifications of the moving or propelling part of his invention; such as placing a series of oblique paddles, or propellers, on arms extending from the centre of the apparatus, as in his former patent; and these he again proposes to vary, according to circumstances, in number, magnitude and position.

This propelling apparatus is placed near the stem of the vessel, with the axis in a vertical position, and the opening at the circumference of the paddle box made to communicate with the water in which the vessel floats through an opening in the stern, while the openings near the centre of the box are made to communicate with the exterior water through the bottom of the vessel.

The application of the invention to raising or forcing water, is effected by connecting the induction openings with the well or reservoir from which the water is to be raised, and a delivery pipe with the eduction opening, and thus the machine becomes a rotatory pump. [*Reg. of Arts.*

Patent to R. W. Sievier *for improvements in the manufactory of Cables, Ropes, Lathe Bands, &c. granted December* 1, 1831.

The ingenuity of this patentee has been developed much more extensively in finding applications for his invention than in the invention itself, which simply consists in the application of strands of caoutchouc, or Indian rubber, instead of strands of hemp or flax, in the manufacture of ropes. The Indian rubber is to be separated into slips of appropriate dimensions, and then drawn out till they are reduced to the thickness required for a strand. Seven, or any other convenient number of the strands, are then placed together longitudinally, and secured together by hemp, flax, cotton, woollen, or other fibrous substance, or by straps of leather, or other suitable material, being woven, knitted, netted, or plaited over the Indian rubber strands. In the manufacture of larger cordage, seven, or any other convenient number of the last are to be bound together in a similar manner, and then as many of this second size are to be united as shall make a cable, if required.

The other purposes besides the cables, ropes, whale fishing and other lines, to which this invention is said to be applicable, are travelling bags, purses, or similar articles, where the difference of the magnitude of their contents renders elasticity in the containing bag of importance. [*Reg. of Arts.*

Specification of the patent granted to John Samuel Dawes, *Iron Master, for certain improvements in the manufacture of iron. Dated December* 22, 1831.

To all to whom these presents shall come, &c. &c.—Now know ye that in compliance with the said proviso, I, the said John Samuel Dawes, do hereby declare the nature of my said invention, and the manner in which the same is to be performed, (that is to say:)—

My improvements in the manufacture of iron are applicable to the processes of smelting, remelting, &c. and consist of, or in, the introduction of certain materials at the bottom or lower part of the blast furnace or cupola, and in continuing such introduction during the above mentioned operations of smelting, remelting, &c. in addition to the usual method of charging the said furnaces at or near the top or tunnel head, by which means I consider that I am enabled to make a larger quantity of iron, of superior quality, with a less quantity of fuel, and with less expensive materials than are commonly used, such as coal uncoked, iron-stone untorrified, &c.

The materials which I use (at the lower end of the furnace,) consist of charcoal, or any other fuel applicable to the purpose, together with any of the well known fluxes, such as alkalies, alkaline earths, lime, metallic, or other, oxides.

The means by which I now effect the introduction of the said fuel and other substances, consist of a conical tube, or feeder, (into which

the said materials are thrown,) fitted to the top, and projecting a little behind the mouth of each blast pipe, (the blast pipes being in the usual situation,) which tubes, or feeders, together with the said blast pipes, communicate with the furnace through large water tuyeres or tue irons, or they may be introduced at any other part of the lower end of the said furnaces, as shall be found best suited to the purpose.

[*Rep. Pat. Inv.*

Patent granted to PIERREPOINT GREAVES, *for making ornamental or fancy Cotton Yarns and Threads, applicable to the making, sewing, or embroidering of Cotton, and other Fabrics. Dated December 22, 1831.*

The skilful combination of the primary colours, so as to produce new shades or self-colours, has proved a puzzling point for the dyer; nay, it is held impossible, by a mixture of dies to produce certain tints in cotton. It is of some importance that this difficulty should be got over; silk embroidery and worsted tapestry, have long been foster sisters to painting; woollen rags have been dexterously made into pictures, and tattered red coats are manufactured into a brilliant tint, but the arts of design have received few favours from cotton, while Manchester and Glasgow know how much cotton owes to the ornaments with which art has loaded it. Now, there is reason to hope from this discovery of Mr. Greaves, that the minutest shades of colour may be produced in cotton yarn and thread; and that future tapestries and brocades, and embroideries, and tambourings in this elegant material, may be manufactured with all the advantage of varied tints, as well as all that grace of *drawing* which some productions in cotton have already manifested. This discovery is not only ingenious and useful, but it is capable of an easy explanation, and may be made clear in few words, with little trouble to the understanding. Mr. Greaves procures a quantity of cotton wool, dyed as usual in each of the primary colours, and without the aid of any machinery, without the slightest additional expense, with no more than the common quantity of labour, he produces his novel and variegated store. He uses the wool as a painter would do the earths, which are called colours from the colours they bear. He takes, for instance, a portion of blue wool of a deeper or a lighter shade, and a portion of pink wool, and mingles these together until the mass is purple, adding red or blue according to the tone he seeks. If he wish to produce a delicate green, he uses a proportionate quantity of blue and yellow; these colours he can make darker or lighter by the addition of a deeper blue up to black, and a paler pink or yellow down to white, for white and black wool may be mingled with the prismatic coloured wools just as they may be with the primary colours in the earths for painting. When he has brought his mixture to the tone he wants, he deals it out to the spinner in the usual quantities, and after it has gone through the common process, and is made into

yarn or thread by the usual means, it retains that tint which the wool acquired by its regular admixture; and thus any work of weaving or sewing in tapestry, tambouring, or embroidery, may be wrought in cotton with the highest degree of perfection.

To copy the finest painting, in cotton, is no longer a matter of insuperable difficulty; and as the task must be delightful, we may well expect some new Miss Linwood to give her attention to a subject so interesting. It is a matter wholly in the hands of the ladies. If a picture be fairly studied—one of the Madonas of a Raphael, for instance—and the necessary colours and shades, and tints noted, and sent to Mr. Greaves, he would no doubt furnish the required quantity of material in the due proportions, and by dint of talent and industry an excellent copy might be produced.

Again, in dresses, what improvements may not be wrought when the trimming and the dress are of the same fabric. In furniture for the bed room, or the sofa, or the chair cushion, what elegant devices may be adopted. The designs of Flaxman, in the frames of Corbould, may yet shine in cotton colours on a music stool, blending nearly all the arts. In shawls, too, how much delicacy will be gained by the new self-colours, and how rare the tints thus to be produced. What enamel is to painting, cotton tapestry may be to that of woollen. We shall have arras hangings again in all probability; at least the *agrémens* of the boudoir may be heightened by this discovery of Mr. Greaves. The new tapestry should be called Pierrepoint. [*Rep. Pat. Inv.*

Patent granted to Claude Marie Savoye, *for improvements in Mills for grinding and reducing Grain. Communicated from abroad. Dated December* 15, 1831.

The inventor desires you to suppose a large solid ring, or hoop, of cast iron, or other metal; it is to be straight and equal on its outer side, as if part of a cylinder, but inside bevilled, or inclined as if a section of a cone: on the upper part of the inside of this ring is cut a series of sharp teeth, which project considerably at their points, and taper down, till they become smooth and equal with the common surface of the metal; or, to use the workman's phrase, quoted in the specification, "diminish till they terminate in nothing." Just at this point, however, there are small gutters, or channels, cut in the iron, at the root of each tooth, and at an angle of inclination; these are to allow the bran or residuum of the corn to pass away, and also to admit air. To the lower edge of this ring are attached "lugs" or ears of solid metal, by which it is to be secured horizontally into a timber frame, of great solidity. This ring represents the nether mill stone. A second ring of the same metal and of equal solidity, but of a less diameter, and of a conical shape, outside, where a set of teeth, corresponding with those of the inner circle of the last described ring, are cut, is made to fit into and act concentrically within it. The serrated sides work against each other, the teeth being, therefore, of course, set differently, those of the inside of the large ring turning their points

one way, those on the outside of the smaller ring turning their points in the opposite direction.

The action is rather cutting than molar, and resembles that of a pair of scissors, more than that of mill stones. However, these rings supply the places of grinders. When the outer circle has been securely fastened by its lugs, or ears, to the beam, or frame of timber we have mentioned, a spindle, or axis, is secured into the centre of the inner ring. It works in a tube, or case, which passes upwards to where an extinguisher-shaped cap surmounts the whole, and downwards to its resting place on a lever, by which the degree of contact between the two rings is regulated. For it stands to reason that very coarse grain might lift the inner ring out of its position, and very fine grain might pass between the rings unground. This is prevented by the lever we have spoken of, the fulcrum of which is a part of the frame work, and which lifts the inner circle out of its position when it is too close to the outer ring, and brings it down again when forced up. To secure it in this latter position there is also a screw to confine its action, and in the tube through which it works, and to regulate its velocity at the same time. Over the extinguisher-shaped cap we have named, is a sort of inverted seive or cylindrical hut, which is the upper covering, and between which and the cap is kept the grain to be reduced, and there its entrance between the rings is equalized.

Another part of the invention is to surround the metal wheels with *annula*, or circular trenches of cold water, keeping the metal cool, and preventing the corrosion of the wheels, and combustion of the grain. This must be a necessary adjunct to every mill whereof the grinding parts are of metal, and although the idea is originally ingenious, the application is manifestly of extreme simplicity. A constant supply of water, and a constant drainage, as it becomes heated, are all that is required. Now as to the power by which this mill is to be wrought, a drawing accompanies the specification, not only of each of the rings, and of a section of the chief parts at work, but of the whole machine. In this the power is by a winch and fly wheel, with the means of adding any supplemental gear to increase velocity. A man's hand is the power, and a crank turning the spindle we have described, causes a partial revolution of the inner ring, and the revolution can be made complete if necessary. Although perfect rotation is not so suited to the invention as a vacillatory or alternate motion, the supposed advantages of this invention are the saving of expense, strength, and economy of space. The application of water is claimed as new, the toothed rings are claimed as new, and there is added a diagram to show that any number of rings may be made to act in the manner of the two described, by which the whole mill would be a series of concentric circles, acting on each other, fed in the same manner, watered also for coolness, and moved with almost the same power.

As a malt mill it appears exceedingly well adapted, and it might be made small enough for a coffee mill, or a pepper mill. To these latter uses we have seen a very similar principle applied.

[*Rep. Pat. Inv.*

Patent granted to Abraham Adolphe Moser, *Engineer, for improvements in certain descriptions of Fire Arms. Dated December* 15, 1831.

This new way of firing muskets, fowling pieces, and pistols, requires a very different mode of loading, and a different sort of lock from those in use at present. The object is to ignite the powder at once by a flame of considerable size within the chamber, and without the narrow passage, or touch hole, which is easily stopped up, and gives out a small line of flame to the powder instead of a broad sheet as it ought to give. No priming, therefore, no percussion caps, are used by Mr. Moser.

His next object is to save time, and prevent the necessity of ramming down the cartridge. It is possible, nay necessary, according to his plan, to make the cartridge so much less in diameter than the calibre of the barrel, as to allow it to run home instantly, by merely dropping it into the muzzle; and to keep it in its place till fired, and give it the force it gains from confinement, a small pin or plug dependent on the trigger guard, contracts the space of the barrel to that of the cartridge by a single motion, and keeps it in its position till the trigger being pulled allows of its escape.

Now the mode of combustion is by a small pellet of detonating mercury secured to a common piece of card wadding, and forming the inner end of the cartridge. This by way of priming. Instead of flint and steel, there is a long pin, secured within a sheath, and moving through the powder chamber by means of strong springs. When the gun is loaded, and the cartridge secured, this pin is quiescent in its sheath; but when the trigger is pulled, the springs expand and force the pin beyond its sheath, to the detonating pellet on which it acts, causing explosion, and creating a sheet of flame within the chamber which is exposed to the powder, ignition takes place, and the gun goes off, the finger is removed from the trigger, the springs recoil, and the pin returns to its sheath till another cartridge is introduced, and it becomes necessary to repeat the action.

The lock is very ingenious, but it is very difficult, perhaps impossible to be described accurately without a marked drawing; the principle, however, is such as we have stated it.

The means of producing the effect by the aid of the pin and the springs, can be very readily conceived, but we confess that the arrangement of the parts is not clear to us after the most careful study of the specification, and we will not attempt to explain what we cannot comprehend. The plug, or stop, by which the cartridge is retained, appears to us a dangerous expedient, and the trigger guard as figured in the drawings is awkward. Neither is the ram-rod dispensed with, though not used in loading the piece.

[*Rep. Pat. Inv.*

Notice respecting the production of Electric, or Magnetic Sparks, from the common Magnet.

"Palmam qui meruit ferat," has always been a favourite motto of ours, and whilst we are ready to award the highest praise to Mr. Faraday for his assiduous, indefatigable, philosopher-like pursuit of the subtle principle and peculiarity of electricity, and of his proofs of the affinity (or identity?) between it and magnetism; and whilst we are equally prompt to bestow our meed of approbation on Dr. Ritchie, for his advancement of the same object, we must offer the palm of perfect success to Mr. Saxton, an ingenious native of Philadelphia, now residing in London, as the original demonstrator of the capability of eliciting a spark from the common magnet. To do this, we must first refer to the Minutes of the Royal Institution.

On the 11th of May, Dr. Ritchie, Professor of Natural Philosophy, stated to the Institution, that he had followed in the track of Mr. Faraday, in his late brilliant discoveries, and was happy to say that he had uniformly arrived at the same conclusions. He had also succeeded in making the spark, which had been obtained by Mr. Faraday in breaking the magneto-electric circle, visible to a large assembly. This was done by placing an explosive mixture of oxygen and hydrogen in the course of the spark, which immediately produced a loud report and a flash of light. He employed a horse-shoe magnet, between the ends of which were placed a couple of tubes; a wire was introduced into each, and their connexion maintained by a conducting medium. The wires were connected to the magnet by the folds of copper riband. The gas was introduced by a bladder and stop-cock; the contact suddenly broken; and the spark made evident by an explosion. Dr. Ritchie declared his belief that no such spark could be elicited from any but a *temporary* magnet.

At this time Mr. Faraday came forward and stated that he had succeeded in obtaining a spark from a *natural* magnet. Mr. Faraday had borrowed Brown's magnet from the academy at Woolwich. A small bar of iron, about six inches long, was used in contact with the extremities of the magnet. Two connecting wires were taken from each end of this small bar, and being bent at right angles, overlapped each other. The undermost terminated in a disc, about the size of half a crown. By a rapid percussion of the bar against the magnet, the disc and wire broke, in contact, by their electricity, and a beautiful bluish spark was produced.

Now, dates are very important to the identification of a discovery, and it is upon these, and upon concurrent testimony, that we rely in support of our conceding to Mr. Saxton the merit of the earliest demonstration of these interesting phenomena in England. It was on the second day of May, that Mr. Saxton first produced an electric (?) spark from a common magnet of very great power, which he was then constructing for exhibition at the New Gallery, in Adelaide street, Strand; and on that, or the following day, the experiment was repeat-

ed in the presence of Dr. Ritchie, who declared it to be the only one he had witnessed. After some trifling improvements had been made by Mr. Saxton, in the apparatus used for breaking the continuity of the subtle fluid, he succeeded in causing the explosion of gunpowder, a much less inflammable material than that used by Dr. Ritchie, from ignition by the spark, which we have, since then, seen him repeatedly perform. Does Dr. Ritchie call Mr. Saxton's magnet one of the *temporary?*

We subjoin a description of the magnet constructed by Mr. Saxton. It is called a horse-shoe magnet, (very elongated,) and is formed of eight shear steel plates, twenty-eight inches in length from the poles to the centre edge, three inches wide, and forming together a thickness of two inches and a half; at the greatest width of the curvature it measures nine inches, and at the poles seven inches across; the poles have a return inwards, towards each other, and are there separated by a space of one inch and a half. The keeper, or lifter, which is made of the purest soft iron, is four inches long, one inch and a quarter wide, and one thick. Around the middle of the keeper, and occupying with its lower section the space between the poles, is a wooden winder, having about one hundred yards of common bonnet wire, threaded, from which the two ends, composed of four lengths of the wire, twisted together, are carried out, with a vertical curve of about three-fourths of a circle, one of these twisted ends passing beyond each end of the keeper, and resting upon the respective poles of the magnet. A small wooden lever is so fixed to the winder and keeper as to admit of the whole being suddenly forced up from the magnet by a smart stroke; and a very beautiful and brilliant spark is invariably elicited, at whichever end of the wire is first separated from the magnet.

It is Mr. Saxton's intention to add several plates to his magnet, and to ascertain, by a series of experiments, the best size for the keeper—the best description of wire to be used—the easiest mode of causing an instantaneous separation of the wire from the magnet, and other interesting consequences, the result of which we shall take occasion to communicate to our readers. [*Lond. Paper.*

On the utility of fixing Lightning Conductors in Ships.

[Continued from p. 205.]

12. Although the application of lightning conductors to buildings on shore is always judicious, and their advantages very apparent, yet on ship board, where the effects of lightning are most to be dreaded, the introduction of this means of defence has been slow and imperfect. The conductor hitherto employed at sea consists of long flexible chains, or links, of metal, about the size of a goose quill, sometimes of iron: those employed in H. M. Navy, however, are of copper; they are usually packed in a box, and are intended to be set up from the mast head to the sea when occasions require, so that, as

observed by Mr. Singer in his excellent work on electricity, partly from inattention, and partly from prejudice, they frequently remain in the ship's hold during long and hazardous voyages quite unemployed; a remark, the truth of which is but too frequently verified in the damage so constantly happening at sea during lightning storms.*

13. The necessity of providing the best possible security against the effects of lightning on ship board has been long admitted, but continuous and fixed metallic rods have been deemed inapplicable to ships, in consequence of their masts, the only parts to which they can be attached, being exposed to chances of injury, to motion in a variety of ways, to frequent elongation and contraction, and to the necessity which frequently arises for removing the higher masts altogether, and placing them on deck. It was probably from these causes that the small flexible chains, or links, above mentioned, were employed. Such conductors, however, will probably, on examination, be found less applicable than fixed continuous lines of metal, and, in every point of view, inefficient substitutes for them. Their great want of continuity, as well as their want of mass and surface, is very unfavourable to the transmission of severe explosions, the electric matter becoming sensible at the points of juncture, as is evident by the sparks which appear upon them at the time of the discharge, so that in some instances they have been actually disunited: they are likewise objectionable as being liable to every species of injury incident to a ship's rigging, and much difficulty is experienced in keeping them in their position, and unbroken, more especially during gales of wind, and at night, when the ship is under sail, and when it is perhaps required, as is already observed, to remove some portion of the higher masts. It has therefore been long considered desirable to apply, if possible, a permanent conductor, which should be always in its place, and ready for action; and various attempts have been made, and suggestions advanced, at different times, to apply fixed lightning conductors in ships, as the subject from time to time has demanded further consideration.

To protect a ship effectually from damage by lightning, it is essential that the conductor be as continuous and as direct as possible, from the highest points to the sea—that it be permanently fixed in the masts, throughout their whole extent, so as to admit of the motion of one portion of the mast upon another; and, in case of the removal of any part of the mast, together with the conductor attached to it, either from accident or design, the remaining portion should still be perfect, and equivalent to transmit an electrical discharge into the sea.

15. To fulfil these conditions, pieces of sheet copper, from one-eighth to one-sixteenth of an inch thick, and about two feet long, and varying from six inches to one inch and a half in breadth, may be in-

* Case (*f.*) p. 204. The conducting chain, at the time of the first explosion, was stowed away in its box below, although set up in time to prevent the effects of the second explosion. A minute account of this will be found on referring to vol. iv. (old series) p. 197, and vol. ii. (new series) p. 63.

serted into the masts in two laminæ, one over the other; the butts, or joints, of the one being covered by the central portions of the other. The laminæ should be rivetted together at the butts, so as to form a long, elastic, continuous line; the whole conductor is inserted under the edges of a neat groove, ploughed longitudinally in the aft side of the different masts, and secured in its position by wrought copper nails, so as to present a fair surface. The metallic line thus constructed, will then pass downward from the copper spindle at the mast head, along the aft sides of the royal mast and top-gallant mast, being connected in its course with the copper about the sheeve holes. A copper lining in the aft side of the cap, through which the top-mast slides, now takes up the connexion, and continues it over the cap, to the aft side of the top-mast, and so on, as before, to the step of the mast. Here it meets a thick, wide, copper lining, turned round the step under the heel of the mast, and resting on a similar layer of copper, fixed to the keelson. This last is connected with some of the keelson bolts, and with three perpendicular bolts of copper, of two inches diameter, which are driven into the main keel upon three transverse, or horizontal, bolts, brought into immediate contact with the copper expanded over the bottom. The laminæ of copper are turned over the respective mast heads, and secured about an inch or more down on the opposite side; the cap which corresponds is prepared in a similar way, the copper being continued from the lining in the aft part of the round hole, over the cap into the fore part of the square one, where it is turned down and secured as before, so that when the cap is in its place, the contact is complete. In this way, we have, under all circumstances, a continuous metallic line, from the highest points to the sea, which will transmit the electric matter directly through the keel,* being the line of least resistance.

16. From what has been already observed, it will be apparent, that, in whatever position we suppose the sliding masts to be placed, whether in a state of elongation or contraction, still the line of conduction will remain perfect, for that part of the conductor which necessarily remains below the cap and top, when the sliding masts are struck, is no longer in the line of action, consequently its influence need not be considered.

17. The following table exhibits the mean proportion of a conductor thus constructed on one mast of a fifty gun frigate, as compared with the copper links usually furnished to the British navy, together with the necessary equivalent in copper or iron bolt, in order to obtain a conductor of the same mass.

The resulting quantities in the last line at the bottom of the table, represent, with the exception of the proposed conductors, the masses, surfaces, and diameters, of cylindrical metallic rods, supposed to extend the whole length of the mast. Thus in column 2, we have

* Since the mizen-mast does not step on the keelson, it will be necessary to have a metallic communication at the step of the mast with the perpendicular stancheon immediately under it, and so on to the keelson, as before, or else to carry the conductor out at the sides of the vessel.

the diameter and surface of a copper rod, containing 2423 cubic inches of metal, being an equal quantity of matter to that in the proposed conductors, and from which it is calculated. The sums, therefore, are not the result of the addition of the successive masts. The same may be observed in column 3; taking the equivalent in iron. In the third and fourth columns, we have the mass and surface of a copper rod of half an inch in diameter, generally allowed to be adequate to any shock of lightning yet experienced: and, lastly, in column 4, we have the mass and surface in the conductors now furnished to the British navy; which we find, as compared with the mass in the proposed arrangement, is only as 94.4 : 2423.

Table.

Succession of Masts.	Proposed conductors.		Equivalent in a copper rod.		Equivalent in an iron rod; taking conducting powers only as 4 to 1.			Mass and surface in a copper rod of 1-2 in. diam.		Mass and surface in present conductors.	
	Mass.	Surface.	Diamet'r.	Surface.	Mass.	Surface.	Diamet'r.	Mass.	Surface.	Mass.	Surface.
	cubic in.	sq. in.	in.	sq. in.	cubic in.	sq. in.	in.	cubic in.	sq. in.	cubic in.	sq. in.
Royal Pole. Conductor 18 ft. 3 in. long, 2 in. wide; two laminæ, each 1-16th of an inch thick.	54	1752	.56	385	216	770	1.12	42	343	10.5	171
Top-gallant mast. Conductor 17 ft. long, 2½ in. wide; two laminæ, one 1-8th of an inch thick, the other 1-16th.	95	2040	.77	493	380	986	1.54	40	320	10	160
Topmast. Conductor 50 ft. long; copper 4 in. wide; two laminæ, each 1-8th of an inch thick.	600	9600	1.1	2070	2400	4140	2.2	117	942	19.2	471
Lower-mast. Conductor 93 ft. long; copper 6 in. wide; two laminæ, each 1-8th of an inch thick.	1674	26784	1.38	4837	6696	9675	2.76	219	1753	54.7	876
	2423	40176	1.2	8064	9692	16128	2.4	418	3358	94.4	1678

18. The manner in which the conductors here proposed, are applied to the mast, gives to the whole the form of a flattened, conical surface,—wide at the base, and diminishing gradually to a point.

It has been stated by one of the most eminent of the French philosophers, that this form is the best possible for a lightning rod.

19. The objections made to fixing lightning conductors in ships, are, for the most part, such as have been urged against lightning rods generally, and are principally as follows:—It is said that by fixing continuous lines of metal in the mast, we *invite* an electrical discharge from the atmosphere, and that by means of an attractive power, which, it is assumed, the metal is possessed of, the explosion is drawn exclusively upon the vessel; that, inasmuch as we can never ascertain the absolute quantity of electric matter which may be discharged from a thunder cloud, it is possible that the transmitting power of any conductors we can apply, may be inadequate to the end in view, so that they may possibly become fused; and hence it is inferred that much damage may be the consequence:—That in fixing lightning conductors in the masts, we can only have *surface*, whereas, the properties of a conductor depend on the *mass*, and not on the *surface* of the metal: hence the metallic surface is calculated to do considerable mischief, by conducting the lightning into the body of the vessel. Such are the principal objections to this application, and which, it is hoped, are fairly stated. They are well deserving serious consideration, but they will be found, on examination, to be inconsistent with experience, and with the known laws of electrical action. We shall, however, by a candid enquiry, give these objections all the attention which their connexion with so important a question demands.

20. The notion that a lightning rod is a positive evil, will be found to have arisen out of the fact already mentioned, (8) namely, that lightning invariably passes through the line, or lines, of least resistance between the points of action; hence it seizes on all those substances which oppose the least resistance to its passage; metallic vanes, vane spindles, iron bars, knives, and pointed metallic bodies, generally, will therefore be very commonly found in the course of the explosion; and from this circumstance, they have been considered to exert an attractive force upon the matter of lightning, so as to draw it aside from its destined course to the destruction of the substances in connexion with them.

21. It will be found, however, that the action of pointed metallic bodies is purely passive; that they only afford, by the aptness of their parts, an easy transmission to the electric matter; so that they can no more be said to attract the matter of lightning, than a dike can be said to attract the water which necessarily flows through it at the time of heavy rain; and, as in the one case, the water is drawn down by a force not peculiarly appertaining to the dike, so, in the other case, the electric matter is determined to a given point, in a somewhat similar way, by a force not appertaining to the metal. More-

over, it may still further be reasoned by analogy, that, as the quantity of water transmitted will depend on the capacity of the dike, and the final protection it gives in conveying the fluid, on the length to which it is continued, so, on the other hand, the protection afforded by a lightning rod will also depend on *its* capacity, and the distance to which it runs. If, in both cases, the length be extended until the force in action be satisfied, the protection received will be as the capacity for transmitting the current: if both be perfect, the protection will be complete; if the dike be not present, the water must be supposed to run loose and undirected; or, if its continuity be frequently interrupted, or narrowed to a small compass, the damage must then be supposed to happen in the intermediate spaces. Such is, in fact, the way in which all bodies of the conducting class already mentioned, (4,) operate in conveying electrical discharges; and it must never be forgotten as an important feature in this discussion, that, whenever we erect an artificial elevation on the earth's surface in the ordinary way, we do in fact, set up a conductor of electricity, upon which the electricity of the atmosphere will fall, and no human power can prevent it. Hence, if metallic bodies be present, those will be first assailed; if not, then the electric matter will fall on the bodies next in conducting power, and so on.

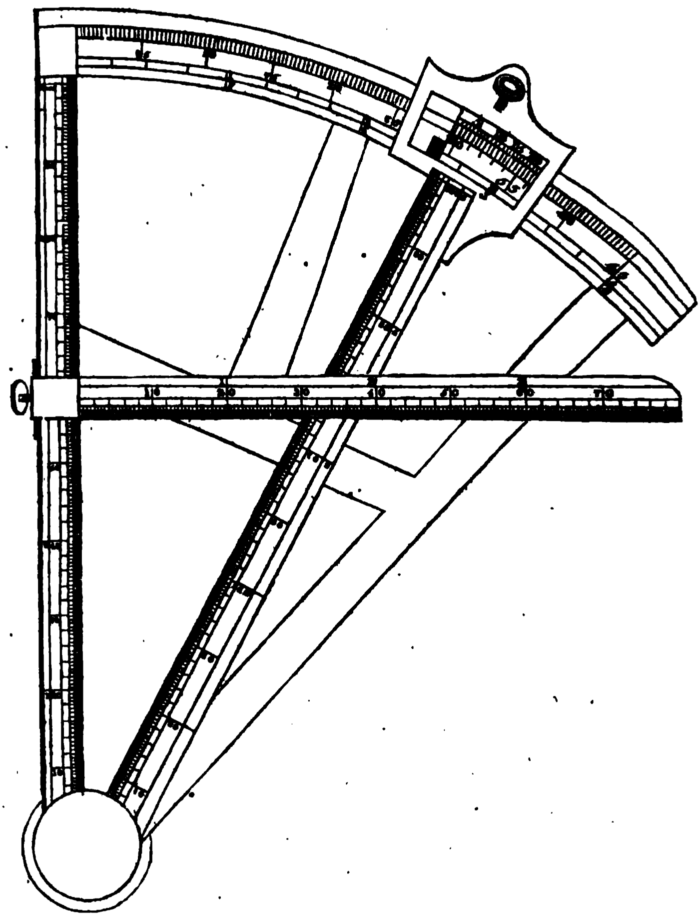
22. A curious illustration of this principle, will be found in an extract from the Memoirs of the Count de Forbin, which is given in the 48th vol. of the Philosophical Transactions. "In the night," says the author of these memoirs, "it became extremely dark, and it thundered and lightened dreadfully. As we were threatened with the ship being torn to pieces, I ordered the sails to be taken in. We saw upon different parts of the ship above thirty St. Elmo's fires; amongst the rest there was one upon the top of the vane of the mainmast more than a foot and a half in height; I ordered one of the sailors to take it down. When this man was on the top, he heard this fire; its noise resembled that of fired wet gunpowder. I ordered him to lower the vane and come down, but scarcely had he taken the vane from its place, *when the fire fixed itself upon the top of the mainmast*, from which it was impossible to remove it."

23. Since, then, the conducting power of bodies differs only in degree, and that the action by which they are assailed, is the result of a great natural agent quite independent of them, we may expect to find all bodies liable to be assailed by lightning, though the effects may be most apparent when the conducting power is imperfect. Thus we find cases on record, of ships struck by lightning, in which no metallic spindles were present, or other iron work about the mast head;* moreover, it is by no means an uncommon circumstance to find trees and rocks rent asunder by lightning, and to hear of men and quadrupeds, even in a plain and open country, destroyed at the

* See Philosophical Transactions, vols. xlix. and lxix., damage done to the sheer hulk at Plymouth, and on board the Atlas, East Indiaman.

time of a thunder storm, when the electric matter strikes the earth's surface. [*Rep. Pat. Inv.*

Crow's Seaman's Octant and Traverse Worker.



The land surveyor has his sliding rule; why should not the navigator also have his instrumental calculator? Mr. Crow, late of

Gravesend, now of London, has furnished an admirable answer to this question, in the octant and traverse worker, shown on the last page. The construction of the instrument is so simple, and its utility so very obvious, that we wonder something of the kind has not been invented before. Seamen work their reckoning at present with the help of printed tables of sines, tangents, &c., which are calculated on the principle, that the sine, tangent, and secant of every angle correspond with the sine, tangent, and secant of the circle which measures that angle, and that the sides of the angle are in the same proportion, one to another, as the sines of the opposite angles. Mr. Crow's octant does this work for them mechanically, and with an accuracy to which no pen and ink, or printed calculations, can possibly pretend. The instrument is of a triangular form, each of the three sides representing the sine, tangent, and secant of the opposite angle. The arc is graduated to 45 degrees, which are subdivided by a vernier into minutes; in the ordinary traverse tables, degrees only are given. The following additional explanations we extract from a small descriptive treatise by Mr. Crow, which accompanies the octant:—

"There is a double row of figures to the degrees, to denote angles and their complements in either case; that is, when the angle is less than 45 degrees, the lower row become the complement of the given angle, and the contrary—only that the minutes found on the vernier are to be subtracted from 20′, and the difference added to the complement will be the degrees and minutes greater than forty-five degrees. When the given angle is less than forty-five degrees, the index is to be placed over it on the arch, in the usual way. Observe always to count from left to right when the angle is less than forty-five degrees, and from right to left when it is more than forty-five degrees. The same observation applies to the scale of rhumbs or points, which are immediately below; for if the course be three points, it shows at once its complement, five points underneath; and if five points be the given course, then the difference of latitude is found on the slide, and departure on the divided limb. Now for the three sides of the triangle—

"First. The diff. of lat. is on that side upon which the slide traverses; and it is also called the divided limb. Here the diff. of lat. is always to be found or laid off, if the course is not more than four points, or forty-five degrees.

"Second. The dep. is the slide, and traverses up and down; upon which the dep. is always to be found or set off, when the course is not more than four points, or forty-five degrees.

"Third. The distance or index. On this side of the triangle the dist. is to be found in the angle of intersection with the slide.

"With respect to the diff. of lat. and dep. one general rule must invariably be observed—it is this: That when the given course is more than four points or forty-five degrees, these sides change names; and so they always do when the diff. of lat. is less than the dep. For if it be a five point course, the diff. of lat. is then to be found on the

slide, and dep. on the limb; and the same is to be observed when the diff. of lat. is less than the dep.; that is, set off the diff. of lat. on the slide, and the dep. on the limb, when these are given to find course and dist.; and the angle of the course thus produced will be found on the arch, and must be read off from right to left, as it will be more than forty-five degrees.*

"Fourth. To find or set off any required number on the sides of the triangle on the common scale, No. 10 to 100 on the limb and index, and to 75 on the slide. Required that the slide should be placed to 53.2 on the diff. of lat. or limb. First, find 53; then take the first subdivision next to this last, is $\frac{2}{10}$; to this place the edge of the slide, and you will then have on the diff. of lat. side 53.2, the number required. But this number may be called 53.20, thus bringing out the result to two decimal figures, which is equal in accuracy to the table of logarithms, only with this great advantage, that the results are had by the instrument tenfold easier and quicker. The same numbers may also be counted 532. Now the large scale is numbered 1 to 5 on the two longest sides, and 1 to 3 on the slide. This scale is convenient when working for the meridianal diff. of lat. as it frequently happens to run up to thousands. If short boards are made, as two to six miles, which often happens in light airs and calms, any distance is readily set off, and the corresponding results expeditiously obtained. Now to suit our convenience, we may assume the first 10 on either of the sides, on the common scale, as one or unity, and 20 above, as 2, 30 as 3, &c.; then will the first division, which is cut up to the second line, be $\frac{1}{10}$, and the longer division $\frac{2}{10}$, &c. &c. In like manner may the first 1 on the large scale be assumed as 10, 2 as 20, 3 as 30, &c.; then will all the longer divisions from 1 to 2, be each 1, or unity, and the subdivisions between these will each become $\frac{1}{10}$. Also may the 1 on the large scale stand for 100, 2 for 200, &c.; the subdivisions then are 1 each. Now admit the distance run to be six miles on a S. W. by S. or three-point course—place the chamfered edge of the index to 3 on the arch, then bring the slide to cut 60, which now stands for six miles, the dist. run, and it is done. On the limb is 5′ for diff. of lat., and on the slide is 3′.3, or a little more, for the dep."

The treatise from which we have made the preceding extract, contains also numerous examples of the mode of calculating by means of the instrument; and these are so distinct and clear, that he must be a dull sailor indeed, who after reading and working them, should find himself at a loss to resolve, by means of the octant, any case whatever in practical navigation.

We should think it a matter of regret, were this instrument to supersede altogether what Jack calls head-work; but, we apprehend, it is quite as likely to lead him to the sufficient reason, in most cases, as the means he at present employs. Of books, there is a mechani-

* To work and read off by this instrument, it is intended that the heel, or angular point, should be towards the body.

cal use, as well as there is of instruments. To what Mr. Crow says on this head, every inquisitive landsman who has traversed the deep sea, can bear witness.

"How few among that useful class of men, plain practical sailors, are able to go to any extent into the basis of the science of navigation, and who continually are working their various problems without ever thinking further than that they are to add together certain numbers, and subtract others; and that if they do this right, they at last arrive at the desired result! This instrument will insensibly impress upon the minds of those who use it, that in every triangle all the parts bear a rigid and definite relation to each other, and that having certain things given, certain others can thence invariably be found; and that any three things that can be brought to the shape of a triangle, become, thereby, objects of simple computation, whether they are distance, difference of latitude and departure, or the mainmast, a main shroud, and the horizontal line joining that mast and shroud along the deck."

Besides, as the results produced by this instrument must necessarily be perfectly correct, it furnishes an excellent means of verifying computations, and must, on this account alone, be of great use to the young and inexperienced.

We earnestly hope that Mr. Crow will not go without the reward which he deserves for this valuable contribution to nautical practice. He acknowledges to have received "liberal support and approval from the Hon. East India Company;" but speaks of the introduction of the instrument into the Royal Navy, as "a hope yet to be indulged." How is this? To whom can the improvement of navigation be of more importance than to the government of this, the first maritime nation in the world? Thousands and tens of thousands have been lavished by it on inventions, (Rotch's fid, for example) of not a tenth part the importance. [*Mech. Mag.*

¶ *Selections from Professor Babbage's Work "on the Economy of Machinery and Manufactures."*

Lace made by Caterpillars.

A most extraordinary species of manufacture, which is, in a slight degree, connected with copying, has been contrived by an officer of engineers, residing at Munich. It consists of lace, and veils, with open patterns in them, made entirely by caterpillars. The following is the mode of proceeding adopted:—

Having made a paste of the leaves of the plant, on which the species of caterpillar he employs feeds, he spreads it thinly across a stone, or other flat substance, of the required size. He then with a camel's hair pencil, dipped in olive oil, draws the pattern he wishes the insects to leave open. This stone is then placed in an inclined position, and a considerable number of the caterpillars are placed at

the bottom. A peculiar species is chosen, which spins a strong web; and the animals commence at the bottom, eating and spinning their way up to the top, carefully avoiding every part touched by the oil, but devouring every other part of the paste. The extreme lightness of these veils, combined with some strength, is truly surprising. One of them measuring twenty-six and a half inches by seventeen inches, weighed only 1.51 grains, a degree of lightness which will appear more strongly by contrast with other fabrics. One square yard of the substance of which these veils are made weighs four grains and one-third, whilst one square yard of silk gauze weighs one hundred and thirty-seven grains, and one square yard of the finest patent net weighs two hundred and sixty-two grains and a half.

Convenient method of Gauging.

The time and labour consumed in gauging casks partly filled, has led to an improvement which, by the simplest means, obviates a considerable inconvenience, and enables any person to read off, on a scale, the number of gallons contained in any vessel as readily as he does the degrees of heat indicated by his thermometer. A small stop-cock is inserted near the bottom of the cask, which it connects with a glass tube of narrow bore fixed to a scale on the side of the cask, and rising a little above its top. The plug of the cock must be turned into three positions: in the first it cuts off all communication with the cask: in the second, it opens a communication between the cask and the glass tube: and in the third, it cuts off the connexion between the cask and the tube, and opens a communication between the tube and any vessel held beneath the cock to receive its contents. The scale of the tube is graduated by opening the communication between the cask and the tube, and pouring into the cask a gallon of water. A line is then drawn on the scale opposite the place in the tube to which the water rises. The operation is repeated, and at each successive gallon a new line is drawn. Thus the scale being formed by actual measurement,* both the proprietor and the excise officer see, on inspection, the contents of each cask, and the tedious process of gauging is altogether dispensed with. Other advantages accrue from this simple contrivance in the great economy of time which it introduces in making mixtures of different spirits, in taking stock, and in receiving spirits from the distiller.

Diamonds for Cutting Glass.

The art of using the diamond for cutting glass has undergone, within a few years, a very important improvement. A glazier's appren-

* This contrivance is due to Mr. Henneky, of High Holborn, in whose establishment it is in constant employment.

tice, when using a diamond set in a conical ferule, as was always the practice about twenty years ago, found great difficulty in acquiring the art of using it with certainty, and at the end of a seven years apprenticeship, many were found but indifferently skilled in its employment. This arose from the difficulty of finding the precise angle at which the diamond cuts, and of guiding it along the glass at the proper inclination when that angle is found. Almost the whole of the time consumed, and of the glass destroyed in acquiring the art of cutting glass, may now be saved by the use of an improved tool. The gem is set in a small piece of squared brass, with its edge nearly parallel to one side of the square. A person skilled in its use now files away one side of the brass, until, by trial, he finds that the diamond will make a clean cut, when guided by keeping this edge pressed against a ruler. The diamond and its mounting are now attached to a stick similar to a pencil, by means of a swivel, allowing a small angular motion. Thus the merest tyro at once applies the cutting edge at the proper angle, by pressing the side of the brass against a ruler; and even though the part he holds in his hand should deviate a little from the required angle, it communicates no irregularity to the position of the diamond, which rarely fails to do its office when thus employed.

The relative hardness of the diamond, in different directions, is a singular fact. An experienced workman, on whose judgment I can rely, informed me that he had seen a diamond ground with diamond powder on a cast iron mill for three hours without its being at all worn, but that changing its direction with reference to the grinding surface, the same edge was ground down.

Example of the method of Calculating by Machinery.

As the possibility of performing arithmetical calculations by machinery may appear to non-mathematical readers to be rather too large a postulate, and as it is connected with the subject of the *division of labour*, I shall here endeavour in a few lines to give some slight perception of the manner in which this can be done, and thus remove a small portion of the veil which covers that apparent mystery.

That nearly all tables of numbers which follow any law, however complicated, may be formed, to a greater or less extent, solely by the proper arrangement of the successive addition and subtraction of numbers befitting each table, is a general principle, which can be demonstrated to those only who are well acquainted with mathematics; but the mind, even of the reader who is slightly acquainted with that science, will readily conceive that it is not impossible, by attending to the following examples. Let us consider the subjoined table. This table is the beginning of one in very extensive use, which has been printed and reprinted very frequently in many countries, and is called *a table of square numbers*.

Terms of the table.	A table of squares.	B first difference.	C second difference.
1	1		
		3	
2	4		2
		5	
3	9		2
		7	
4	16		2
		9	
5	25		2
		11	
6	36		
		13	
7	49		

Any number in the table, column A, may be obtained by multiplying the number which expresses the distance of that term from the commencement of the table by itself; thus 25 is the 5th term from the beginning of the table, and five multiplied by itself, or by five, is equal to 25. Let us now subtract each term of this table from the next succeeding term, and place the results in another column, (B,) which may be called first difference column. If we again subtract each term from this first difference from the succeeding term, we find the result is always the number two, (column C;) and that the same number will always recur in that column, which may be called the second difference, will appear to any person who takes the trouble to carry on the table a few terms further. Now when once this is admitted as a known fact, it is quite clear that, provided the first term (1) of the table, the first term (3) of the first differences, and the first term (2) of the second or constant difference, are originally given, we can contrive the table of square numbers to any extent, merely by simple addition: for the series of first differences may be formed by repeatedly adding the constant difference 2 to (3) the first number, column B, and we then necessarily have the series of odd numbers, 3, 5, 7, &c.; and again, by successively adding each of these to the first number (1) of the table, we produce the square numbers.

Having thus, I hope, thrown some light upon the theoretical part of the question, I shall endeavour to show that the mechanical execution of such an engine as would produce this series of numbers, is not so far removed from that of ordinary machinery as might be conceived. Let the reader imagine three clocks, placed on a table side by side, each having only one hand, and each having a thousand divisions instead of twelve hours marked on the face, and every time a string is pulled let them strike on a bell the number of divisions to which the hands point. Let him further suppose that two of the clocks, for the sake of distinction called B and C, have some mechanism by which the clock C advances the hand of the clock B one division for each stroke it makes upon its own bell; and let the clock B, by a similar contrivance, advance the hand of the clock A one division for each stroke it makes upon its own bell. With such an ar-

rangement, having set the clock A to the division I, that of B to III, and that of C to II, let the reader imagine the repeating parts of the clocks to be set in motion continually in the following order: viz. pull the string of clock A; pull the string of clock B; pull the string of clock C.

Repetition of process.	Movements.	Clock A. — Hand set to I.	Clock B. — Hand set to III.	Clock C. — Hand set to II.
		Table.	1st. diff.	2nd. diff.
1	Pull A.	A strikes - 1		
	— B.	The hand is advanced (by B) 3 divisions.	B strikes - 3	
	— C.	- - -	The hand is advanced (by C) 2 divisions.	C strikes 2
2	Pull A.	A strikes - 4		
	— B.	The hand is advanced (by B) 5 divisions.	B strikes - 5	
	— C.	- - -	The hand is advanced (by C) 2 divisions.	C strikes 2
3	Pull A.	A strikes - 9		
	— B.	The hand is advanced (by B) 7 divisions.	B strikes - 7	
	— C.	- - -	The hand is advanced (by C) 2 divisions.	C strikes 2
4	Pull A.	A strikes - 16		
	— B.	The hand is advanced (by B) 9 divisions.	B strikes - 9	
	— C.	- - -	The hand is advanced (by C) 2 divisions.	C strikes 2
5	Pull A.	A strikes - 25		
	— B.	The hand is advanced (by B) 11 divisions.	B strikes - 11	
	— C.	- - -	The hand is advanced (by C) 2 divisions.	C strikes 2
6	Pull A.	A strikes - 36		
	— B.	The hand is advanced (by B) 13 divisions.	B strikes - 13	
	— C.	- - -	The hand is advanced (by C) 2 divisions.	C strikes 2

If now only those divisions struck and pointed at by the clock C be attended to and written down, it will be found that they produce the series of the squares of the natural numbers.

Meteorological Observations for September, 1832.

Moon.	Days.	Therm. Sun rise	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches.				Inches.	
☽	1	56°	70°	29.84	29.84	49	NW.	Moderate.		Clear day.
	2	53	71	30.00	30.00	48	W.	do.		Clear day.
	3	58	70	.00	.00	60	S.	do.		Light clouds—rain.
	4	51	69	29.80	29.70	69	S. SW.	do.	.70	Rain—cloudy.
	5	59	67	.64	.70	52	NW. W.	Breeze.		Flying clouds—clear.
	6	48	68	.84	.84	58	W.	do.		Clear day.
	7	56	78	.80	.71	60	SW.	do.		Cloudy—clear.
	8	54	72	.90	.85	51	SW.	do.		Clear—flying clouds.
	9	50	71	.94	30.5	49	W.	do.		Clear day.
☺	10	51	78	30.20	.90	57	N. S.	do.		Clear—flying clouds.
	11	59	80	.00	29.90	67	SE. S.	Blustering.	.25	Cloudy—rain—rain in n't.
	12	58	66	29.80	.84	54	W.	do.	.15	Clear day.
	13	46	61	30.10	30.10	44	W.	Moderate.		Clear day.
	14	44	80	.10	.10	49	W.	do.		Clear—light clouds.
	15	54	72	.10	.04	58	W.	do.		Cloudy—clear.
	16	60	81	.00	.00	70	W.	do.		Clear day—slight thunder
☾	17	64	79	.00	.00	66	N.	do.	.1	Clear day. [shower.
	18	59	78	.20	.20	63	SW.	Calm.		Clear day.
	19	58	69	.14	.00	68	SW.	Breeze.		Clear day.
	20	64	77	29.93	29.93	61	SE.	do.		Fog—cloudy.
	21	64	74	.70	.70	60	E.	do.		Cloudy day.
	22	66	69	.70	.70	56	S.	do.		Drizzle—cloudy,
⊗	23	58	62	.80	30.00	48	NW.	do.	.1	Clear—cloudy.
	24	48	52	30.00	29.90	55	SE.	do.		Cloudy day—rain in n't.
	25	54	63	29.70	.80	45	W.	Blustering.	.7	Cloudy—flying clouds.
	26	43	63	30.00	30.00	47	W.	Moderate.		Clear day.
	27	51	70	29.96	29.90	50	W.	do.		Cloudy—flying clouds.
	28	62	72	.98	.96	61	SE	do.		Cloudy—flying clouds.
	29	62	69	.83	.70	61	NNE. N.	do.		Cloudy day.
	30	56	68	.70	.70	61	SW.	do.		Cloudy day.
	Mean	55.33	70.33	29.92	29.91	56.9			1.19	

		Thermometer.	Barometer.
Maximum height during the month,		89. on 11th and 14th.	30.20 on 10th and 18th.
Minimum	do.	44. on 14th.	29.64 on 5th.
Mean	do.	63.08	29.92

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

DECEMBER, 1832.

Remarks upon the recent patent for a Shot, and Shell, with Spiral Flanches.

TO THE COMMITTEE ON PUBLICATIONS.

Gentlemen,—The October number of your Journal contains an account of the specification of a patent, granted to William B. Pier and Andrew Mark, of Detroit, Michigan Territory, "for an improvement in the science of gunnery, which may be used as a substitute for the ordinary bomb shell, or howitzer, &c." It can, I think, be shown that the patentees have been anticipated in the principles of their invention, and that various defects to which, in practice, their plan would be liable, have been avoided in the prior invention to which I allude. If these facts are so, while one must regret the expenditure of ingenuity, of time, and, perhaps, of money, already encountered by the patentees, it can but be a service to them to prevent their more serious loss of each, which, probably, will be consequent on endeavours to bring the scheme into use, under the sanction of a patent right which cannot be sustained.

It is well known that a canon ball, whatever pains may have been taken in its casting, is, as a general rule, not of uniform density throughout; as a consequence of this, if a ball were supposed to leave the muzzle of a gun without having acquired a rotary motion, the forces which act upon it in its flight would produce such a motion. This is especially the case with hollow shot, or shells, the construction and loading of which effectually prevent the coinciding of the centre of gravity with the centre of the shell. These projectiles are placed in the mortar, from which they are thrown, with the fusee towards the muzzle; immediately on leaving the muzzle the fusee is seen turn-

ed in the opposite direction, and a rotation which may be very distinctly traced in night firing, is commenced about a line inclined to the axis of the mortar. This rotation produces not only a deviation in the shell, or shot, in the vertical plane passing through the axis of the piece, but also from that plane. In small arms, the defects just stated are remedied by grooving the barrel, as in the rifle. By these grooves a tendency to rotation is produced in the ball while passing through the barrel; a rotation which the action of the air, upon the grooves produced in the ball, tends to keep up. The axis of rotation coincides with that of the barrel, and there is no tendency produced to vary the curve in the plane of projection, nor to depart from that plane; under these circumstances the aim becomes certain.

We may suppose the patentees to have reasoned upon some such principles in their endeavour to give to larger projectiles the accuracy of flight of the rifle ball. They propose to effect this by using spiral flanches upon their shells, or shot, by which to give a rotation similar to that produced in the rifle. The form of the shot, independently of the flanches, "is that of an elongated egg with the small end truncated, or cut square off." "The large, or forward end, which nearly fits the calibre of the piece, is a solid hemisphere of metal, the weight of which will insure its keeping the proper direction when fired from the piece." This form is admirably calculated to defeat the object to be accomplished by the flanches, and would seem to show that I have attributed too much practical knowledge of the motion of projectiles to the patentees. It is certain that the solid hemisphere in front, instead of increasing the accuracy of the fire, would, by a tendency to descend, at the instant of leaving the piece, begin a rotation about an axis perpendicular to the axis of the piece, the effect of which on the rotation to be produced by the flanches, parallel to that axis, is obvious.

The shell now patented is "to be made to explode by means of percussion powder. For this purpose a hole is to be drilled through the larger end, or bulb, of the shell, in the direction of the axis." "An iron or steel bolt surrounded by leather, or other elastic substance, is put over the percussion powder, and extends out from the front of the shell; its exterior end widens out like a nail or bolt head. This striking against any hard substance, occasions the contents of the shell to explode."

I shall show that the patentees have been anticipated in their design of using spiral flanches, and, also, in their project for making a shell to explode when it strikes; unless, indeed, in relation to the latter point, the use of a conical plug of iron, covered with leather, instead of a wooden cylinder, be, *technically*, of importance. With regard to the form of the shell, if my remarks be correct, it is very defective.

To prove the positions taken, I shall give extracts from a "Description of a Percussion shell,* to be fired horizontally from a common gun. By Lieutenant Colonel Miller, late of the Rifle Bri-

* Transactions of the Royal Society of London, Part I, 1827.

gade," &c. This paper was published in 1827, and purports to have been read before the Royal Society of London, on the 16th and 23d of November, 1826.

After giving an outline of the theory of the rifle, Col. Miller details experiments, by which he proved that a rotary motion about the longer axis of a projectile might be given to it by grooving the projectile itself. The cylindrical form was first tried, and subsequently an attempt made to terminate the cylinder by a hemisphere, which failed. The conclusions drawn from the experiments are thus stated.

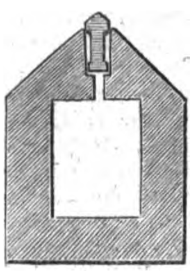
"Having, as I conceived, conclusively ascertained by experiment, that the spiral motion might be communicated to a grooved cylindrical ball fired from a plain barrel, it occurred to me that by the help of this principle, shells might be so constructed as to explode by percussion. The plan I have adopted for this purpose will be easily understood by an examination of the annexed figure.* A, round peg is placed in the apex of the cone, working in a cylinder, and a pellet of percussion powder is placed under the peg, and over the vent which communicates with the cavity of the shell. By this means, as soon as the point of the peg strikes against any hard substance, it slides in, and ignites the percussion powder, which instantly communicates with the bursting charge."

An account of experiments with these shells in different situations, with various charges, and fired at different objects, is next given: two series of these experiments were made in 1823, and a third in 1826. From these the following conclusions are drawn.

"So far as range and efficiency are concerned, the experiments have perhaps been as successful as could have been expected, in so novel an invention. With respect to accuracy of fire, I am fully sensible that much still remains to be done; and to those who ask why this most important object was not more completely attained before the discovery was submitted to the public, I beg leave to answer, that no invention in gunnery, so far as I am aware, either in former or more recent times, has ever been brought to perfection without the help of long continued and laborious experiments, which from their nature are so expensive that they cannot be expected to be prosecuted at the cost of any individual. In the present instance, only one hundred and four shells have been fired altogether, eighty-five of which were filled with powder, and, out of these, thirty-nine exploded upon striking the objects fired at. In the experiments made at Woolwich, on the Pheasant, sloop of war, in the river, which are certainly the most important that have yet been made, only eleven succeeded out of thirty-one; no great number certainly, but at the same time enough to have destroyed the vessel had they been heavy metal. The fire at present is sufficiently accurate for the range at which naval actions are generally fought, but the object in view is to make them available to the full extent of their range, and I shall accordingly point out the means by which I conceive this object may

* See the cut on p. 364.

be very much facilitated. Considerable improvement may, I think, yet be made in the mode of casting them; for although the gentlemen of the Carron Company have bestowed great pains on those that were cast by them, it seldom happens, in matters of this kind, that the most simple process is discovered in the first instance. They may also be turned in a lathe by means of machinery, which their shape will allow them to be with great facility, and thus rendered perfectly cylindrical, and of the same size. In the course of the experiments that have been made, the shell has also been greatly improved by an addition to the length originally given to it. This might, a priori, have been expected, as its weight is increased without increasing the resistance of the air; and by this alteration its range is found to be increased also. The accuracy of fire is also found to be greater, as the angle of departure is diminished. Hence, greater accuracy of fire may be expected from heavy guns than from light ones, the sides of the shells in the former being much longer than in the latter, while the windage in both is equal. The following construction of a shell for a nine pounder, I consider as the best, so far as the experiments made will allow me to determine. In these proportions the length of the sides is increased half an inch beyond that of any yet used, and the twist is reduced from fifty-five to seventy-two inches.



Length,	6.24	inches.
Diameter,	4.16	„
Length of sides,	4.16	„
Height of cone,	2.08	„
Depth of grooves,	0.20	„
Width of ditto round the circumference,	0.80	„
Length of peg,	1.40	„
Diameter of ditto,	0.40	„
Diameter of vent,	0.15	„
Thickness of sides,	0.85	„
Thickness of bottom,	0.74	„
Diameter of chamber,	2.46	„
Height of ditto,	3.42	„
Windage,	0.04	„

The necessity of *perfectly* balancing the shell is insisted on, and a method of effecting it is given in the paragraph which follows.

"In all the experiments already made, it has been observed that the line of fire is generally good, but that the shells which have missed the object, went almost invariably either too high or too low, which is exactly the result we might, from theory, expect, when their ends are not perfectly balanced. The method of proving whether their ends be exactly balanced, is by floating them in mercury, their specific gravity when filled being something less than half that of mercury. When properly balanced, they float horizontally, and the balance is not perfect until that is effected."

The successful experiments of the Messrs. Stevens, of New York, with shells exploding on striking an object, were prior to those of Col. Miller; the details of them, and the method of accomplishing

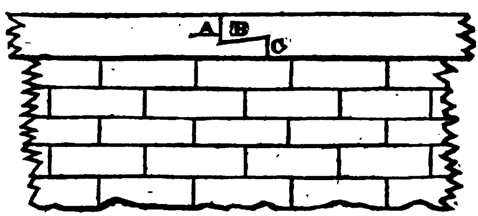
their object, were, I believe, never made public. The form of the shell differed from that of Col. Miller, as well as that of the recent patentees.

B.

Expansion and Contraction of Coping Stones.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—Observing in your number for July, 1832, that the contraction and expansion of coping stones had been attended with unpleasant consequences in the opening of the joints, I take the liberty of handing you the annexed sketch for the joints of coping stones, which has been found sufficient to protect the wall from the drip at the joints. If the joints are made as in the sketch the water can never injure the wall through them.



It is necessary that the water should pass through the joints A, B, C, to get to the wall, but this is effectually prevented by the inclination of the joint B. It is more expensive than the common method, but needs no cement, and the ordinary contractions and expansions can never injure it.

I am, sir, respectfully,

Your obedient servant,

W. T.

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, to ascertain, by experiment, the value of Water as a moving Power.

[Continued from p. 302.]

TABLE 8.—PART I.

WHEEL No. IV.—30 *Oblique buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	0.25	0.50	1.00	1.00	57	23.07	80.07	40.0	38½	5.64	625	6.50	40625	32028	.788			
2					71	23.20	94.20		42	5.16	730		47450	37680	.794			
3					85	23.33	108.33		47½	4.57	825		53625	43332	.808	.808	4.57	
4					99	23.46	122.46		57½	3.77	955		62075	48984	.789			
5				1.25	71	23.20	94.20		37½	5.77	750		48750	37680	.773			
6					85	23.33	108.33		47½	4.57	855		55575	43332	.779			
7					99	23.46	122 46		50	4.34	965		62725	48984	.781	.781	4.34	
8					113	23.59	136.59		55½	3.90	1085		70525	54636	.775			
9				1.50	85	23.33	108.33		38½	5.64	880		57200	43332	.757			
10					99	23.46	122.46		41½	5.22	990		64350	48984	.761			
11					113	23.59	136.59		48½	4.47	1085		70525	54636	.775			
12					127	23.72	150.72		54	4.01	1190		77350	60288	.779			
13					138	23.82	161.82		54½	3.97	1240		80600	64728	.803	.803	3.97	
14					146	23.90	169.90		59	3.67	1315		85475	67960	.795			
15				1.75	132	23.77	155.77		47½	4.57	1295		84175	62308	.740			
16					146	23.90	169.90		49½	4.38	1385		90025	67960	.755			
17					160	24.03	184.03		55½	3.90	1490		96850	73612	.760			
18					174	24.16	198.16		57	3.81	1580		102700	79264	.772	.772	3.81	
19					202	24.42	226.42		61½	3.52	1830		118950	90568	.762			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE 3.—PART II

WHEEL No. IV.—30 *Oblique buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bk t.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
20	0.25	0.50	1.00	2.00	132	23.77	155.77	40.0	44	4.90	1355	6.50	88075	62308	.707			
21					160	24.03	184.03		49½	4.38	1560		101400	73612	.726			
22					174	24.16	198.16		54	4.01	1660		107900	79264	.734			
23					202	24.42	226.42		59½	3.64	1870		121550	90568	.745	.745	3.64	
24	0.75	1.00	1.50	0.75	113	23.59	136.59	40.0	33½	6.47	1050	7.00	73500	54636	.743			
25					132	23.77	155.77		37	5.86	1195		83650	62308	.745			
26					146	23.90	169.90		41½	5.22	1305		91350	67960	.744			
27					160	24.03	184.03		43	5.03	1405		98350	73612	.748			
28					174	24.16	198.16		46½	4.67	1505		105350	79264	.753			
29					188	24.29	212.29		66½	3.25	1575		110250	84916	.770	.770	3.25	
30					216	24.55	240.55		79½	2.73	1825		127750	96220	.754			
31					230	24.68	254.68		59	3.67	1930		135100	101872	.754			
32					235	24.73	259.73		60½	3.58	2000		140000	103892	.742			
33				1.00	132	23.77	155.77		32½	6.67	1205		84350	62308	.739			
34					216	24.55	240.55		73	2.97	1770		123900	96220	.777	.777	2.97	
35					230	24.68	255.68		62½	3.47	1885		131950	101872	.772			
36					249	24.86	273.86		71	3.06	2070		144900	109544	.756			
37					263	24.99	287.99		58	3.74	2170		151900	115196	.758			
38					277	25.12	302.12		62	3.50	2325		162750	120848	.743			
39					291	25.25	316.25		63½	3.41	2445		171150	126500	.739			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE 3.—PART III.

WHEEL No. IV.—30 *Oblique buckets.* *Close Breast.* *Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
40	0.75	1.00	1.50	1.25	305	25.38	330.38	40.0	56½	3.83	2500	7.00	175000	132152	.755			
41					319	25.51	344.51		60	3.61	2580		180600	137804	.763	.763	3.61	
42					333	25.64	358.64		61	3.55	2715		190050	143456	.755			
43				1.75	352	25.82	377.82		59½	3.64	3055		213850	151128	.707			
44					366	25.95	391.95		61	3.55	3135		219450	156780	.715	.715	3.55	
45					380	26.08	406.08		63	3.44	3250		227500	162432	.714			
46					394	26.21	420.21		64½	3.36	3375		236250	168084	.712			
47					408	26.34	434.34		68	3.19	3530		247100	173736	.703			
48	1.75	2.00	2.50	0.75	291	25.25	316.25	40.0	59	3.67	2250	8.00	180000	126500	.703	.703	3.67	
49					319	25.51	344.51		64½	3.36	2500		200000	137804	.689			
50					333	25.64	358.64		66	3.28	2600		208000	143456	.690			
51				1.00	338	25.69	363.69		48½	4.47	2625		210000	145476	.693			
52					352	25.82	377.82		46½	4.67	2700		216000	151128	.700	.700	4.67	
53					366	25.95	391.95		50½	4.32	2805		224400	156780	.699			
54					380	26.08	406.08		59	3.67	2920		233600	162432	.695			
55					394	26.21	420.21		63½	3.41	3040		243200	168084	.691			
56					408	26.34	434.34		69½	3.12	3200		256000	173736	.679			
57	2.75	3.00	3.50	1.50	319	25.51	344.51	40.0	38	5.71	2380	9.00	214200	137804	.643			
58					333	25.64	358.64		40	5.42	2475		222750	143456	.644	.644	5.42	
59					352	25.82	377.82		42½	5.10	2630		236700	151128	.638			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table 4.

Wheel No. IV.—30 *Curved buckets. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	0.25	0.50	1.00	0.50	113	23.59	136.59	40.0	37½	5.78	1080	6.50	75600	54636	.723			
2					127	23.72	150.72		40½	5.35	1185		82950	60288	.727	.727	5.35	
3					146	23.90	169.90		47	4.61	1360		95200	67960	.714			
4				1.00	85	23.33	108.33		44	4.90	850		55250	43332	.784			
5					99	23.46	122.46		52½	4.13	940		61100	48984	.802	.802	4.13	
6					127	23.72	150.72		63	3.44	1180		76700	60288	.786			
7					146	23.90	169.90		73½	2.95	1355		88075	67960	.772			
8				1.25	113	23.59	136.59		49	4.43	1105		71825	54636	.761			
9					132	23.77	155.77		57½	3.77	1255		81575	62308	.764			
10					146	23.90	169.90		60	3.61	1360		88400	67960	.769	.769	3.61	
11	1.75	2.00	2.50	0.25	132	23.77	155.77	40.0	52	4.17	1170	8.00	93600	62308	.666			
12					146	23.90	169.90		55½	3.90	1270		101600	67960	.669			
13					160	24.03	184.03		55½	3.90	1360		108800	73612	.677	.677	3.90	
14					174	24.16	198.16		50½	4.29	1475		118000	79264	.672			
15					188	24.29	212.29		65	3.34	1625		130000	84916	.653			
16				0.50	160	24.03	184.03		37½	5.78	1460		116800	73612	.630			
17					174	24.16	198.16		52	4.17	1460		116800	79264	.679	.679	4.17	
18					188	24.29	212.29		43	5.03	1620		129600	84916	.655			
19					216	24.55	240.55		47½	4.57	1905		152400	96220	.631			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE 5.—PART I.

WHEEL No. IV.—30 *Curved buckets of fig. 5, Plate VIII. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Seds.	Feet.	Pds.	Feet.						
1	0.42		1.17	2.25	146	23.90	169.90	40.0	47½	4.57	1380	6.67	92046	67960	.738			
2					160	24.03	184.03		52	4.17	1455		97048	73612	.758			
3					174	24.16	198.16		53	4.09	1570		104719	79264	.757			
4					188	24.29	212.29		57½	3.76	1675		111722	84916	.760			
5					202	24.42	226.42		63½	3.42	1800		120060	90568	.755			
6					216	24.55	240.55		64½	3.36	1820		121394	96220	.793			
7					230	24.68	254.68		68	3.19	2030		135401	101872	.752			
8					235	24.73	259.73		78	2.78	2100		140070	103892	.742			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE 5.—PART II.

WHEEL NO. IV.—30 *Curved buckets of fig. 5, Plate VIII. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	2.75		0.84		85	23.33	108.33	40.0	47	4.63	1480	6.67	98716	43332	.439			Water run over the gate 2¼ inches deep, when drawn entirely open with 6 ft. 8 inches head and fall—wheel removed one inch from breast—tail-way one-eighth in. from bottom of wheel.
2					113	23.59	136.59		55	3.93	1515		101050	54636	.541			
3					127	23.72	150.72		58	3.74	1645		109722	60288	.550			
4					146	23.90	169.90		65	3.34	1790		119393	67960	.569			
5					160	24.03	184.03		64	3.39	1870		124729	73612	.590			
6					174	24.16	198.16		68	3.19	1975		131399	79264	.603			
7					188	24.29	212.29		71	3.06	2100		140070	84916	.606			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

[TO BE CONTINUED.]

Quarterly Meeting.

The thirty-fifth quarterly meeting of the Institute was held at their Hall, October 18, 1832.

Alexander Ferguson was appointed Chairman, and

Frederick Fraley, Recording Secretary, P. T.

The minutes of the thirty-third quarterly meeting were read and approved.

The thirty-fifth quarterly report of the Board of Managers was read and accepted, when, on motion, it was referred to the committee on Publications, with instruction to publish it in the Journal of the Institute.

The quarterly report of the Treasurer was read and accepted.

On motion, the reading of the thirty-fourth quarterly report of the Board of Managers was called for, as a quorum sufficient to transact business did not attend on the evening appointed for that meeting, and the report was not read; after reading the report it was accepted and referred to the committee on publications for insertion in the Journal of the Institute.

Professor A. D. Bache made some remarks on the art of medal ruling, in which he claimed the credit of the present useful application of it for America: he submitted specimens of the work executed by Asa Spencer, of Philadelphia, to the meeting, and the first published specimen of the execution of Mr. Bate, of London, contained in Prof. Babbage's work on the economy of manufactures and machinery. He drew a comparison between the works, favourable to that of Mr. Spencer, remarking that the distortion produced by the method used by this artist, although it would become perceptible in works of very high relief, was scarcely so in medal ruling, and did not turn the balance in favour of the work of Mr. Bate of which the specimen was exhibited.

A copy of the diploma of membership of the Institute, just finished, was laid on the table for the inspection of the members.

Extract from the minutes.

Alexr. Ferguson, *Chairman.*

Frederick Fraley, *Rec. Sec. P. T.*

Thirty-fourth Quarterly Report of the Board of Managers of the Franklin Institute.

Hall of the Franklin Institute, July 12, 1832.

The Board of Managers respectfully present to the Institute their report for the second quarter of the present year.

Preparations are making for the exhibition of American manufactures to be held in October next, and for the reopening of the schools and commencement of the lectures.

It is hoped that in addition to the usual courses, an efficient series of lectures on machines may be introduced. The difficulty in the

way of this important course lies in the models and machinery necessary for illustration. The Institute have not the funds to supply these. It is hoped that the zeal of the individual members may be relied upon to promote by the gift or deposit of suitable models and machinery, this useful and interesting object.

The Board of Managers have given the fullest consideration to the subject referred to them at the last Quarterly meeting, viz. the better accommodation of the lecturers of the Institute.

They find that an extension of the present accommodation could be obtained only in one of two ways; either by depriving the members of the privilege which they now enjoy in the reading room and library, or by taking from the institution revenues which are necessary to the payment of the interest on, and the gradual extinction of, the debt for which it stands pledged.

While, therefore, the Board consider that the better accommodation of the lecturers, by appropriating separate rooms to the lecturer on chemistry, and to the lecturers on Natural Philosophy and Mechanics, is very desirable, they cannot see in the present state of the institution circumstances which would warrant the undertaking.

Having twice in the course of this report referred to the limited nature of the funds of the Institute, the Board of Managers would take this occasion to submit a few remarks, in relation to the funds by which inquiries, connected with the objects of the Institute, have been carried on.

The expenses of the important experiments on water power were defrayed by individual contributions, and not by the Institute.

The later researches under the direction of the committee on explosions, were commenced at the request of the Secretary of the Treasury of the United States, and are making at the expense of the Department.

The sum appropriated to the committee on statistics has not been considerable in amount, and this amount was granted under the impression that a measure originating with the members of the Institute, at one of their quarterly meetings, must fail, unless the funds asked by the committee were provided.

The Journal of the Institute is now able to support itself, and will, probably, before a great while, redeem the loan made on its assumption by the Institute.

Thus it appears that important objects have been accomplished, and are accomplishing, without drawing from the treasury of the Institute the sums required to extinguish the debt for which it is pledged, and which, remaining unpaid, must always trammel the operations of the institution.

The Board announce with regret the resignation of Franklin Bache, M. D. Professor of Chemistry in the Institute. The efficient services of this gentleman have secured to him the respect and esteem of those with whom he has now for six years been connected.

Isaac B. Garrigues, *Chairman.*

William Hamilton, *Actuary.*

Thirty-fifth Quarterly Report of the Board of Managers of the Franklin Institute.

Hall of the Franklin Institute, October 11, 1832.

The Board of Managers submit to the Institute their report for the third quarter of the present year.

Since the last report several changes have taken place in the affairs of the institution, which are of interest.

The committee on Premiums and Exhibitions, by the advice of the committee of arrangement, determined to postpone the usual exhibition of domestic manufactures, in relation to the time of holding which they had received authority from the managers to decide. The gloomy state of a sister city, the apprehension which our own community, in conjunction with all others, felt in anticipation of the extensive prevalence of a wide spreading epidemic, rendered prudent the course adopted by the committee.

The resignation of our Professor of Chemistry, which the Board of Managers had the regret to announce in their last report, was followed by the appointment of John K. Mitchell, M. D. as his successor. The talents and attainments of this gentleman are well known to the members of the institute. The zeal with which he has entered upon the preparations for the ensuing course, give an earnest of his exertions to carry it to a successful completion.

On the last day of August, the rooms on the third floor of the hall were given up by Professor Johnson. The schools having at that time made their arrangements for the year, the rooms could not at once be rented. The Institute, on this account, though temporary sufferers, will ultimately be benefitted, since the delay has given time for a division of the third floor into six rooms. By this division the Drawing school and the English school will have suitable accommodations, a room for Models and Machinery be provided, and a rent be obtained.

The lectures for the ensuing season will commence on the last Monday in October, (October 25th,) the introductory lectures will be given on Monday, Wednesday, and Saturday, of the first week, after which the regular lectures of the course will commence. The chemical lectures will be given every Monday evening, those on natural philosophy every Wednesday, and those on machines every alternate Saturday evening. It is expected that volunteer lectures will occupy the alternate Saturday evenings.

The Board would again call the attention of the members to the promotion, by the gift or deposit of suitable models and machinery, or by donations in money, of the course on machines. Such a course as cannot fail to be useful as well as interesting has been sketched out by the lecturer on that branch, Franklin Peale, Esq. the completion of which must, in a great degree, depend upon the liberality of the members of the Institute. To those who have already come forward with subscriptions the Board return their acknowledgments.

The better accommodation of the Drawing school, to which the

Board has already alluded, is calculated to increase the popularity of that important school. The English evening school of the Institute, will be opened on Monday evening, October 15th, in the eastern room on the third floor of the hall. This school will be, as last year, under the charge of Seth Smith, Esq. It is hoped that the patronage of the members of the Institute, will be freely extended to this school; the qualifications of the teacher, and the highly creditable manner in which the system of his school was carried forward during the last year entitle him to their entire support.

The inquiries in practical science undertaken by the Institute are continued. The report of the committee on water wheels has, as far as the experimental part is concerned, been nearly completed, and that of the committee on the explosions of steam boilers is in progress. The branch of the investigations of the latter committee connected with the strength of materials, is steadily progressing. Many of the members have been present at a portion of the experiments, and have perceived the extent of labour which has been undertaken: time and great perseverance on the part of the committee are required to accomplish all the objects within the scope of the inquiries.

The diploma of membership has been prepared, and the insertion of the names of members is all that is wanting to make it ready for delivery.

Respectfully submitted.

Isaac B. Garrigues, *Chairman.*

William Hamilton, *Actuary.*

Analysis of the Report, &c. on Steam Carriages.

Report on Steam Carriages by a Committee of the House of Commons of Great Britain. With the minutes of Evidence, and Appendix. Reprinted by order of the House of Representatives of the United States. (1832.)

The next witness examined was Richard Trevithick, the individual who, with Evans, first brought the high pressure engine into use; the first to attempt locomotion *on rail-roads* by the mere adhesion of the wheels to the rails. Trevithick informs us that he has for many years resided out of England, and indeed his testimony fully shows this, his ideas in relation to the high pressure engine being those of twenty years since: he gravely contends that every time the elasticity of steam is doubled a saving of seventy-five per cent. in fuel is made! he is full of a new project of a safe and most economical boiler, which he describes, and which he supposes will replace every other, whether used by water or by land, in ships or in fishing boats, in stationary or locomotive engines, on rail-roads or on turnpikes, for manufactures or for agriculture.

There are some interesting points in Mr. Trevithick's testimony, which, together with the description of his boiler, we give below.

Mr. Trevithick is of opinion that high pressure boilers have never exploded by the direct pressure of steam, unless when suddenly produced. In proof of this he states that portable gas holders are one-sixteenth of an inch thick, and ten inches in diameter, and are loaded with thirty atmospheres, or 450 lbs., and yet they never burst, while boilers of this, or greater thickness, have burst when provided with valves loaded to only one-eighth part of this pressure, and less. His theory of explosion is that of water suddenly thrown in foam upon the red hot sides of a boiler.

The new engine of Mr. Trevithick is thus described.

"The fire-place, boiler, and condenser are formed of six wrought iron tubes standing perpendicularly on their ends, encircled the one within the other for the purpose of safety, and to occupy little room, also for keeping the boiler to one constant gauge, with fine distilled water, permanently working without loss, by condensing the steam and never suffering it to escape out of the engine, but returning it from the condenser back again into the boiler every stroke of the engine by a force pump; and were an engine perfectly tight, it would work forever without a replenish of water. But, to supply leaks, a small evaporating apparatus is used for supplying the deficiency with distilled water, which effectually prevents any fluctuation in the height of water in a boiler or collection of sediment, and an impossibility of ever getting the boiler red hot, there being no space for the water to fly out of the boiler but into the condenser; and this is so small, that if, by any means, the force pump did not return the water regularly from the condenser to the boiler, the space in the condenser, by taking one inch in depth of water out of the boiler, would fill and glut the condenser so, that the engine would stand still, and, as the water cannot diminish it does not require a large quantity of water, or water space in the boiler, so necessary in other engines, to guard against fluctuation in the feed, and prevent the boiler becoming red hot. The boiler being considerably less, the strength and room will be increased, and, never getting hot, the engine might be worked with much higher steam; even as high as the pressure which gas holders are charged with, the theory gives a saving of fuel, weight, and room, over low pressure engines of sixteen to one, without a supply of water. I state this to show the probable advantages that will arise from this new engine. For my engine to be one hundred horse power, and to raise sufficient steam, the fire tube must be three feet diameter, which would give the boiler a diameter of three feet eight inches; and that a half inch thick, according to the theory of the strength of iron, would sustain a pressure of 1736 lbs. to the inch, which is four times as great as the gas holders are charged with, and thirty-two times the pressure that the high pressure engines work with at present, which is still farther proof that the explosions have been solely occasioned by the boilers being under water gauge, and heated red hot. If, after boilers have been forced on their trial by cold water pressure, to stand ten times the pressure that they are to be worked at, and a boiler should happen to explode, the shock would be first received by the next surrounding tube, and so on for six successive surrounding tubes; each space between the tubes would admit the steam to escape gently up the chimney without harm, and the outside tube that encircles the whole, might be made of three-quarters of an inch thick, so that it would put injury from explosion beyond possibility. The arrangement of this new engine embraces every advantage that can be wished for; safety, saving of fuel, lightness, little room, cheapness, simplicity, and nearly independent of water, it can be made applicable to any purpose, and much more effectual than horse power, the first cost of erection far less than a quarter the cost of horses, for the duty performed, independent of the difference of expense between coals and horses' feed, because a one horse engine will, by constant work, perform the work of four horses every twenty-four hours."

Mr. Trevithick's claims in relation to locomotion are so exaggerated that we quote before commenting upon them.

"Below is stated the commencement of both my high pressure and locomotive steam engines, with the advantages derived from them. Since 1804, at which time I invented and erected this high pressure engine, up to the present time, little improvement has been made in addition to my own. The first locomotive engine ever seen was one that I set to work in 1804, on a rail-road at Merthyr Tydvil, in Wales, which performed its work to admiration, and a correct copy of which is now in general use on the rail-road. The advantages gained by this improvement was a detached engine, independent of all fixtures, working with five times the power of Boulton and Watt's engine, without condensing water, and the fire enclosed in the boiler surrounded with water, and a forced draught created by the steam for the purpose of working on the roads without a high chimney; and from this was copied all the boilers for navigation engines, which, without it, could not have been made available; this being independent of brick work, light, safe from fire, and occupying little room."

With regard to Mr. Trevithick's attempt in 1804, it is admitted by the English author, Wood, not to have been successful, of which indeed we have the proof in the fact that Trevithick himself proposed to roughen the rims of his wheels to obtain greater adhesion; that Blenkinsop introduced the cogged middle rail, and that such crude contrivances as a chain stretched along the middle of the road, and the jointed leg, were proposed, and tried, to remedy the supposed defect of want of adhesion. It is just possible to see, in the imperfect way in which the escape steam acted in Trevithick's chimney, the germ of the method now employed, with such success, by Stephenson, for producing draught by its current.

Davies Gilbert, Esq. next presented to the committee for examination his judicious remarks upon wheels, springs, draught, &c. published many years since. As they have been for some time before the public, it is not necessary to insert them here. We extract certain additional remarks in relation to economy of steam conveyance, at different speeds, on land and on water.

"The slow conveyance of heavy weights may perhaps be effected by steam on well-made and nearly level roads, so as to supersede the use of horses; but steam power is eminently useful for producing great velocities. It was last year determined by the Society of Civil Engineers, after much inquiry and discussion, that the expense of conveying carriages drawn by horses was at its minimum when the rate of travelling equalled about three miles an hour, and that expense increased up to the practical limit of speed, nearly as the velocity; including the greater price of horses adapted to swift driving, their increased feed and attendance, the reduced length of their stages, and, with every precaution, the short period of their services. On the contrary, friction being a given quantity as well as the force requisite for impelling a given weight up a given ascent, the power required for moving steam carriages on a rail-way remains theoretically independent of its speed, and practically increases but a very little, in consequence of resistances from the atmosphere, slight impacts against the wheels, inertia of the reciprocating piston, &c. The expenditure of what I have termed efficiency, is, as actual force, multiplied by velocity, and the consumption of fuel in a given time will be in the same proportion, but the time of performing a given distance being inversely as the velocity, the expenditure of fuel will, theoretically, be constant for a given distance, and very nearly so in practice. The power requisite for moving bodies through water is in the opposite extreme; here, the mechanical resistance of the fluid increases with

the square of the velocity, as do the elevation of the water at the prow, and its depression at the stern.* The oars, or paddles, must, therefore, preserve a constant ratio to the velocity of the vessel; and the force applied will consequently vary as the square of the velocity; and the expenditure of efficiency being as the force multiplied by the velocity; the consumption of the fuel will be as the cube of the velocity in a given time, or as the square of the velocity in a given space; and I have ascertained from the records of voyages performed by steam vessels, that the law is nearly correct in practice: hence the great power required for such steam vessels as are constructed not merely for speed, but also to set at defiance the opposition of winds and seas; while, on the contrary, a very small power will be found sufficient for moving ships of the largest dimensions through the water, at the rate of two or three miles an hour, when their sails are rendered useless by continued calms."

The next witness examined, Mr. Nathaniel Ogle, is joint patentee with Mr. Summers, in a boiler, engine, and carriage, adapted to locomotion on common roads. His testimony bears stronger marks of enthusiasm than of accuracy. He tells us that "rail-roads, except in very peculiar situations, are behind the age;" and we are disposed to believe that he gives full credence to his own remark. He does not seem to have been particular in measuring speeds or estimating weights, and treats the subject of tolls with considerable contempt. "I have paid near London, when trying experiments, a shilling or two, and I made no inquiry. I remember going out of London, throwing one man a shilling, and another two, being too much occupied to trouble myself about the matter."

The desideratum which Mr. Ogle considers to be realized in his boiler, is the combination of a great extent of heating surface with a limited space and perfect safety. The working pressure is 247 lbs. to the square inch on the safety valve. A description of the boiler is given which we cannot understand. It is said to present 250 square feet of fire surface in a space of three feet eight inches high, three feet long, and two feet four inches broad, and to weigh eight hundred weight.

The carriage has three wheels, the centre wheel being a guiding wheel. The adhesion of only one wheel is employed except in rising hills. The weight of the carriage and engine, with water and fuel, is stated at about three tons.

The results of trials of speed are given as from thirty-two to thirty-five miles an hour over a wet road with patches of gravel, which speed might have been continued for an indefinite time, or have been increased over a good road to forty miles. "From the turnpike gate at Southampton, to the four mile stone on the London road, a continued elevation, with one very slight descent, at a rate of twenty-four and a half miles an hour, loaded with people." "Ascended one of the loftiest hills in the district, near Southampton, at sixteen and a half miles an hour." "Ascended a hill with a soft wet bottom, rising one foot in six, at rather a slow rate."

A slope of one in six is about nine and a half degrees! When we consider that the greatest slope in our turnpike which crosses the Allegheny mountains is not greater than about five degrees, we are tempted to inquire where such a slope was found in the neighbourhood of London. The remarks of Mr. Ogle on the relative effect of horses' feet, and of the wheels of carriages upon turnpikes, are very judicious, but as we shall have occasion to refer to similar ones, it is not necessary to detail them.

* This is certainly an error.—Rev.

The next witness, Mr. Alexander Gordon, is an engineer, who states his principal experience to have been derived from the experiments of Mr. Gurney. He describes the two patents taken out by his father in 1822 and 24, both of which were unsuccessful. The first was a locomotive within a drum which it rolled along, propelling a coach in front. The second was a carriage moved by iron propellers.* Both the schemes proved failures.

The information given in relation to the relative wear of roads by wheels and by the feet of horses, seems to be founded on data of doubtful authority, and not skilfully used. The facts relating to the relative wear by steam coaches and the ordinary coach are of a different cast, and, to all appearance, have been drawn from close observation; the inference from them is that the wheels of a steam coach, the driving wheel included, do not do more apparent injury than those of the ordinary coach.

The testimony of Mr. Joseph Gibbs, engineer and patentee of a new boiler, and who was the next witness examined, presents no particular point of interest except that which relates to the freedom from slipping of the driving wheel in a locomotive; the carriage upon which the observation was made was Mr. Gurney's.

After travelling over a flinty road the tire was examined and found to be free from furrows extending around the wheel, which would have been produced had the wheel slipped.

The examination of Thomas Telford, Esq. is the next in order; it occupies but little space. The subjects to which it is directed are the relative injuries to roads by horses, by common carriages, and by steam carriages.

Mr. Telford considers that a horse does much more injury to a good road than the carriage which he draws, and that the mere pressure of a carriage can, in such a case, produce little effect. With regard to the question of the relative wear by common and by steam carriages, he professes a want of experience, but gives a qualified opinion in favour of the less injury which would be done by a steam carriage, than by a common coach of the same weight.

We next have the testimony of the partner of Mr. Ogle.

His statements upon points noticed in Mr. Ogle's testimony agree tolerably except as to speed, in the statement of which he is not very clear. He places the average speed at nearly ten miles an hour, the locomotive carrying nineteen persons. Then speaks of going up a hill, of a slope of one in twelve, at the rate of fifteen miles per hour. The discrepancy he attributes to the variation in the intensity of the fire. After a change made in the fire place is spoken of, Mr. Summers states that his carriage went frequently at the rate of thirty miles an hour for four miles and a half.

He gives a most favourable statement of the performance of his boiler, viz. "We have never found it necessary to clean it yet: it has been in operation more than twelve months." "We have had water of every description." "Every time we have arrived at our journey's end, we opened a cock communi-

* Both these locomotives are figured in the lithographic print entitled the "Progress of Locomotion. By Alexr. Gordon, Engineer."

cating with the bottom of the boiler; perhaps we do not give the matter (sediment) time enough to rest: it is all blown out at the pressure of 240 lbs. on the square inch."

The method of urging the draught is thus spoken of:

"Instead of blowing our waste steam into the chimney, in order to produce a draught, we have a fan or blowing machine, which is driven by the engines when in operation, and this gives us intensity of heat in the furnace. The waste steam from our engines goes into a double casing round the furnace; we admit a small portion underneath the fire bars of the grate, and the remainder is allowed to expand itself into the double casing, after which it comes over the top of the fire, and escapes in the form of invisible vapour.

"Then, in fact, you arrive at the same result, but with this difference, that you increase the draught of the fire by using a certain quantity of the power of your engine, whilst those who introduce the steam into the chimney increase the draught by a power which you throw away? We have tried it in both ways, but we find this the most advantageous, because in those carriages in which the steam is driven into the chimney to produce a draught, the aperture is so much diminished in order to produce velocity of current and corresponding increase of draught, that the waste steam is choaked in escaping from the engines, and produces a greater loss of power than by working the fan."

Mr. Summers' remarks drawn from his experience in the different varieties of road, &c. will be read with interest. He adheres to the slope of one in six, upon which we have remarked, and says that he has measured it: all men are liable to errors, and we repeat that one in six is nine and a half degrees.

"From your experience in steam carriages, do you conceive that it will be necessary to make any alteration of the present roads, such as paving them for the purpose of this mode of conveyance? No, certainly not; we have found that our vehicles will travel over every kind of road with great velocity, and up the steepest hills. From observation which I have made very minutely on the operations of the vehicle, my decided opinion is, that if the common roads were put into a tolerably good state of repair, we should be able to carry all the goods which a rail-way would be able to carry, and at much less expense, taking into consideration the original expense of the rail-way, and its continued wear and tear. I believe I have ascertained, from a correct source of information, that every yard of rail-way loses on an average about four ounces per year in weight, when it is in full operation. This loss arises from oxidation, and the action of the great numbers of wheels of the carriages that pass over it."

"Have you travelled over pavements? Very frequently."

"Did you find that your carriage travelled with greater ease over them? With much greater ease."

"Supposing you had a pavement to run on, what increase of power should you gain by running on that rather than on a common Macadamized road? We find that when we are travelling on a rough, bad pavement, we do not consume more than one-fourth of the steam we do on a gravelly soft road."

"You conceive you increase your power three-fourths on a paved road? Yes."

"What steepness of hill have you ever ascended? One foot in six; I measured it myself: that is, the hill at Shirley."

"Were there any symptoms of the wheel slipping in that case? Not the slightest: we had both the wheels in gear at the time we ascended it."

"At what velocity did you ascend it? At a velocity of nearly five miles an hour."

"What weight had you? We had fourteen or fifteen persons on the carriage."

"Did you find any difficulty in working? Our engines worked with perfect freedom."

"What distance did you travel on that ascent? The hill is about 200 yards long."

"You are now improving the form of the carriage—are you not? Our present operations are in improving the form of our vehicle, and the arrangement of the different parts of the machinery."

"For what number of passengers will your present carriage be calculated? Eight inside, and sixteen outside passengers."

"How many wheels have you? Our present vehicle is on three wheels; our proposed carriages will be on four wheels."

"In what space can you turn on a road? We have frequently turned entirely round on the London road leading from Southampton, in the space in which a post-chaise can turn, or rather less."

"Supposing you were travelling at the rate of ten miles an hour on a level road, in what number of feet do you suppose you should be able to stop your carriage entirely? We should be able to stop the vehicle in the space of twelve feet. I have ascertained this from experiment: when we were descending Staine's bridge, which is very steep, one of the crowd fell down in front of the vehicle, very near the vehicle; we immediately reversed the action of the engines, and the man escaped without any injury."

"When you state that you can stop in twelve feet, is that by reversing the action of the engines? No; by merely shutting off the communication between the boiler and the engine."

"But supposing you were in such a situation that it would be requisite to stop in a much shorter distance, could you do it instantaneously by reversing the engine? We could certainly stop in the space of three feet by reversing the engines; but it would not be prudent to do so in less, as it might endanger the lives of the persons on the vehicle by their being pitched or thrown forward."

Mr. Summers proposes tolls in proportion to the number of passengers carried, making those of steam coaches only one-half those of stage coaches, carrying the same number of passengers, on the ground of the less injury which they do to the road.

Mr. Stone, next examined, is the engineer of Sir Charles Dance's steam coach.

He states that they have run regularly for five months between Gloucester and Cheltenham, (25 miles?) with the occurrence of only a single accident, the breaking of an axletree. The greatest weight drawn he rates at eleven tons, and this was drawn at the rate of five to six miles an hour; the weight of the carriage was two tons. They have carried between three and four thousand passengers. This coach had been reported by the surveyor of the Gloucester and Cheltenham road as a nuisance, from the alarm which horses on the road took at it, noise, &c.

Mr. James M'Adam was next questioned, particularly in relation to the relative effect of wheels, and of the feet of horses, upon roads, and upon the method of charging tolls upon steam carriages. Pleading want of experience in relation to the effects produced by steam carriages, the information which he gives in relation to the latter question is conjectural. That referring to the effects of common carriages upon roads, and to the construction of these latter, will be read with interest.

"Have you made any experiments, or are you able to give any information to the committee, as to the comparative wear of roads, or injury to roads by carriages and horses passing? I have generally found that horses' feet do very great injury to the surface of a well-made road; and I am of opinion that a carriage, with properly constructed wheels, does less injury to a road than the horses' drawing.

"Would you explain what the operation of the injury done to the road is by travelling on it: is it the wear of the road, or the displacement of the materials? Both take place; the wheels, to a certain degree, wear out the material, but, upon a road properly constructed, and that has become consolidated, and the surface smooth, that wear is very small and gradual; the injury to the road from the horses' feet, more especially upon gravel and flint roads, arises, particularly in dry weather, from the knocking up and displacing the materials upon the surface, and each succeeding journey adds to the evil, and were it not for the effect of the wheels following the horses in mitigation of that evil, we should have the flint and gravel roads all loose throughout the whole summer."

"But the wheels of the carriage do not actually follow in the track of the horses? But in roads of much thoroughfare, especially near the metropolis, other carriages do."

"On the metropolis roads have you made any new regulations as to the mode of charging tolls, by weight or otherwise? In the last act passed for the metropolis roads, the toll was put upon the horse drawing, and a regulation as to the formation and breadth of the wheels expressly enacted, by which all wheels were required to be not convex, but a perfectly flat surface, with no projecting nails; but, by the powers granted to the commissioners in that act, that perfectly flat surface was mitigated to a surface not exceeding a quarter of an inch from the flat surface; to meet the practical effect arising from the wear of the wheels upon the road, and to prevent litigation at the several gates, by applying a gauge, a toll of 3d. per horse for each seven miles is payable upon a six-inch wheel so constructed; a quarter more upon a wheel so constructed of four inches and a half in breadth, and a half more upon a wheel less than four inches and a half. Those additions do not apply to stage coaches, or carriages with springs. The toll upon all horses drawing carriages and coaches with springs is 3d. a horse for seven miles, whatever may be the breadth of the tire."

"You have had no reference to the weight of the carriage drawn in your rate of the tolls? There is no reference to the weight drawn in any wagon or such like carriage, provided the wheel is of the construction required by the act, and the result of some years' experience proves that no injury whatever is sustained upon a well made road, from any weight practically carried in wagons, or such like carriages, with wheels as described."

"You do not mean that the committee should infer weight is of no consequence, but that the power of the horse will be your guard against an over-weight being drawn? Yes; the toll being laid per horse, I consider that the penalty in the shape of toll per horse, more than compensates for the injury done by the weight. Before those regulations took place, the roads, in truth, sustained an equal pressure, from the well known fact that the weighing engines were universally compounded for by all the carriers, and that the roads after these regulations, had no greater but even less weights to sustain than before that took place, and it was observing that fact which induced the commissioners of the metropolis roads to do away with all the weighing engines."

"Do you know whether the Holyhead road commissioners are trying to do away with the necessity of weighing engines? Upon the trusts, on that line of which I am surveyor, the trustees have done away with all the weighing engines, and the happy result of compelling the wagons to set out and arrive upon the metropolis roads with properly constructed wheels, has had the effect of enabling the trustees upon all the roads within a circle of fifty to eighty miles, to dispense with the weighing engines; also, because if the wagons set out and arrive in the metropolis district with a properly constructed wheel, it was not

worth their while to alter it, but to travel throughout to Cambridge, Newmarket, &c. with the same wheel; and the benefit of the metropolis wheel has extended itself in consequence."

"Then supposing a broad wheel wagon with dished wheels was to pass through your turnpike, what rate would be charged? It would be charged the highest rate of a narrow wheeled wagon."

"Have you heard any complaints from the wagon masters of the regulation of the form of the wheel? On the contrary, a few days since, we had a petition most numerously signed by the wagon masters from Norwich, Cambridge, Newmarket, &c., requesting the trustees of the Wadesmill road to dispense with the use of their weighing engine, they having found by experience that the wheels required by the metropolis commissioners, were not only best for the road, but the most advantageous for themselves to use, and in consequence of that application, on Friday last, the only remaining engine on the roads of which I am surveyor, was ordered to be abandoned."

"Can you state the weights of a loaded stage coach, and a loaded wagon, and a loaded van, on the average? I should state a stage coach loaded, at from two and a half to three tons; a wagon from five tons to seven and a half."

"Does that include the weight of the wagon? Eight tons would; I should think the weight of the vans about four or five tons."

"Have you observed the operation of wheels when they are dragged? Yes; they are injurious upon roads newly coated certainly, but upon an old road, I mean a road that has become consolidated upon the surface, the injury, with proper skid pans, is but small, and confined, of course, to one side of the surface of the hill."

"Do you think the efficacy of your toll in protecting the road is equally applicable to a heavy van as to a loaded coach? I think that the toll per horse will always be a sufficient guard for the weights drawn; the van being on springs does infinitely less injury, in proportion, than such a weight without them."

"But if the injury to the road proceeds from the weight the horses have to draw, the same rate of toll would not be applicable to a carriage of two tons and one of six tons, both being drawn by four horses? Certainly not; but that is a supposition hardly fair to be taken, because we conclude that the additional weight requires additional horses."

"But in practice the vans pass all through the country with only four horses, and the coaches equally with four horses? That is true; the coaches go at a much more rapid pace."

"Do you think that the velocity with which a coach goes, has any thing to do with the wear of the road, or is it not actually less injurious in proportion to its velocity? In some instances, where any blow takes place, the speed does more injury to the road by crushing the materials."

"You did not contemplate the general use of vans when that act was drawn up? No; not that they would come into such general use."

"What proportion of the injury to the road do you think takes place from the changes of the atmosphere; frost and wet, has it any material effect? Yes, decidedly, in chalk soils in particular; at Royston, and through that country, a great and serious injury takes place upon the breaking up of all frosts, nor can we, by any care, or attention, or strength of surface of the road, prevent that taking place; it comes in a very eccentric manner, and breaks up one year at one part of the road, and another at another, occasioned in a great measure by the standing of the water in the sub-soil; and I suppose also, by the way in which the wind is at the time it freezes. It is the modern practice of road making to abstain from all general repair of the roads from the middle of April until the middle of October; during that period, the only repairs that ought to take place are partial coatings, necessary from accidental circumstances. As soon after the middle of October as possible, the general coating takes place in pieces of the road at a time, so as to interfere and interrupt as little as possible with general travelling; and we endeavour, by the month of February to have the whole of the coatings put on; in no instance above a sixth part at a time."

The quotations from the remarks of Mr. John Macneil, assistant engineer to Mr. Telford on the Holyhead road between London and Shrewsbury, and London and Liverpool, are, we think, of much interest.

"On an average line of road, of not less than 100 miles, on which, in many places, materials of very inferior description must have been used, both in its formation and subsequent repair, what is the maximum weight per wheel (say if not less than four inches width of tire,) which should be carried on any kind of carriage (carriage weight included,) without risk of injury to the road? On a road, such as here described, the injury will be considerable by any wheel passing over it, but without a more defined statement of the quantity and quality of the materials used, I do not think this question can be answered with any degree of certainty. On all gravel roads, however, made without a foundation or bottoming, I should say the weight on a four inch wheel, should not exceed fifteen cwt., and on a wheel less than that ten cwt. On the generality of roads, throughout the country, I do not think it would be safe to run a carriage with almost any width of wheel if the load much exceeded ten tons; in fact there are some bridges even between London and Birmingham, that it would be running a risk to pass over with a carriage weighing ten tons."

"Can you, from observation, say what proportion the breadth of the tire of wheels should bear to the weight? The breadth of tire in proportion to the weight, will depend entirely upon the description of road over which the carriage passes; on the road lately constructed by the parliamentary commissioners of the Holyhead and Liverpool roads, at the Highgate Archway, I have frequently observed wagons, carrying upwards of six tons, pass; the weight of each wheel on the road was then about thirty cwt., and though the bearing of the wheels, from the cause I have before stated, was not more than three inches, the effect produced was imperceptible. The pressure, in this case, was ten cwt. on every inch, which is unquestionably too much for the generality of roads; but if we take the road from London to Shrewsbury as a criterion to judge by, I should say that a wheel ought to be an inch in width for every ton that a carriage and its load weighs; and that if every carriage that now travels that road was limited not to exceed that proportion, the roads would be better, and maintained at a cheaper rate than at present. According to the average weight of coaches and wagons, as stated, I have calculated the following table, showing the weight at present carried on each inch of bearing, and what I conceive might be the breadth of the different wheels if they were made cylindrical, with an even bearing, and in the proportion of one inch of width for every ton including the carriage."

Description of carriage.	Velocity in miles per hour.	Weight, on an average, in tons.	Breadth of the wheels, in inches.	Pressure of each wheel, in cwts.	Pressure on each inch, in cwts.	Breadth of wheel, calculated in the proportion of five cwt. to the inch.
Mail coach,	9 to 11	2	2¼	10.0	4.40	2
Stage coach,	8 to 11	2½	2	12.5	6.25	2½
Van,	6 to 7	4¼	2½	21.25	8.29	4¼
Wagon,	2½ to 3	6	9	25.0	2.77	6
Ditto,	2½ to 3	4½	6	22.5	3.75	4½
Ditto,	2½ to 3	3½	4	17.5	4.37	3½

"State your opinion as to the relative wear of a road by two carriages, both drawn by four horses, one carriage of two tons weight, with two inch tires, the other four tons, with four inch tires? My opinion is, that the wear of the roads would in each case be the same, as far as it was affected by the wheels of the carriages, probably rather less, by the carriage carrying four tons, on four inch wheels, than by the carriage carrying two tons with two inch wheels; but it must be recollected that both the carriages are supposed to be drawn by the same number of horses, and as the horses drawing the carriage of four tons must use greater exertion than those drawing the carriages of two tons, I am of opinion that the aggregate wear of the road would be more by the transit of the four ton carriage, than by that of the carriage weighing two tons."

"How would the foregoing answer be affected by an increase or decrease of velocity in either carriage? If the road over which the carriages are drawn be hard, solid, and smooth, I think there would be very little increase of wear from the effect of the carriage wheels by an increase of velocity; but if the road should be uneven or rough, there would be an increase of wear, in consequence of the impetus, or blow, with which the wheels would strike the road after passing over the inequalities in its surface, particularly if the carriages were made without springs; but whether the road be a good or a bad one, the wear occasioned by the feet of the horses will be greater when they travel with an increased velocity: for a coach horse which travels at the rate of ten miles an hour, works on an average 270 miles in a month, and wears out in that time about four pounds of iron in shoes; whereas a wagon horse, which travels at the rate of three miles an hour, and works twenty-six miles a day, for four days in the week, goes, on an average, 416 miles in the same period of time, and wears out 4.8 pounds of iron. If the coach horse travels the same distance, the wear would be six-sixteenths, which exceeds the wear of the wagon horse one thirty-sixth. In the same way might the relative injury caused by the wheels of the wagon and the coach be ascertained."

"What is the operation of the atmosphere on roads? Well made roads, formed of clean hard broken stone, placed on a solid foundation, are very little affected by atmospheric changes; weak roads, or those that are imperfectly formed with gravel, flint, or round pebbles, without a bottoming or foundation of stone pavement, or concrete, are, on the contrary, much affected by changes of the weather. In the formation of such roads, and before they become bound, or firm, a considerable portion of the sub soil mixes with the stone or gravel in consequence of the necessity of putting the gravel on in thin layers. This mixture of earth, or clay, in dry warm seasons, expands by the heat, and makes the road loose and open: the consequence is, that the stones are thrown out, and many of them are crushed and ground into dust, producing considerable wear and diminution of the materials; in wet weather also, the clay, or earth, mixed with the stones, absorbs moisture, becomes soft, and allows the stones to move and rub against each other when acted upon by the feet of horses, or wheels of carriages. This attrition of the stones against each other, wears them out surprisingly fast, and produces large quantities of mud, which tend to keep the road damp, and, by that means, increase the injury."

"Supposing the actual wear or deterioration of a road to be represented by 100, and that only coaches, vans, and wagons, have passed over it during any given period, in what proportion would you estimate the effects; first, of atmospheric changes; secondly, of the carriage; thirdly, of the horses? This question can only be answered in a general way; no two lines of road would probably give results at all similar: much will depend on the manner in which the road is constructed, the materials of which it is composed, the care bestowed on its drainage, and whether it be in an open situation, or shaded by trees. If the road be properly made, and in an open situation, the injury arising from the atmosphere will be little, compared with the actual wear caused by the wheels of carriages and the feet of horses, probably not ten per cent. during the year; whereas, on weak roads in clay countries, every shower loosens the materials of which the road is

composed, and causes considerable wear, perhaps thirty per cent. or even more in some situations, where the road is shaded by trees; to get at something like an average proportion between the wear occasioned by horses' feet and the wheels of carriages, I have procured the following facts: the coaches which run between London and Birmingham, require a hundred horses, on an average, to work the up and down coach; the horses are generally shod by contract at about 2s. 6d. (55 cts.) per horse per month; those near London are much larger and heavier, and therefore require heavier shoes than those twenty miles out of London, and from thence to Birmingham; near London, in the flint districts, the wear of horses' shoes is much more than it is in the quartz and limestone countries. At Stoney Stratford, the weight of the four shoes of a mail and stage coach horse averages five pounds, and when taken off at the end of about twenty-eight days, they weigh very nearly two pounds: in this period the horses run 252 miles. At Towcester, Weedon, and Daventry, the weight of the new shoes is one pound and a half each, and, when taken off, they weigh nearly three-fourths of a pound; the length of time which they remain on is about thirty days; this would give a wear of three pounds per horse per month, but if the greater wear near London be considered, I think it would not be too much to allow the wear equal to four pounds per horse per month, which for one hundred horses for ten weeks, would give a wear of 1000 lbs. of iron. The hind wheels of the coaches are mostly four feet eight inches in diameter, and the front wheels, three feet. The width of tire, I before stated, is about two inches, and when new, the thickness of the iron is three-quarters of an inch. These wheels are found to last from two to three months, according to the state of the weather, the workmanship and quality of iron, (about twenty years ago they did not last seven days on an average;) suppose they now last ten weeks, in that time the tire is worn down to one-sixth of its original thickness. This would be equal to 163.4 lbs. or 326.8 for both coaches; this would be to the wear of the horses' shoes as 326.8 to 1000, or as 1 to 3-14ths nearly; now if the injury done to the road by the horses' feet and the wheels of carriages be estimated in the same proportion, I think it would probably be near the actual effect produced; that is to say, the injury done by the wheels of fast coaches is to the injury done by the horses which draw them, as one to three, in round numbers. The effect produced by slow carriages and horses is different: a wagon drawn by four horses, which travels regularly from London to Daventry at the rate of three miles an hour, is worked by fifteen horses; the wagon weighs twenty-five cwt. and carries, on an average, sixty-seven cwt.; the hind wheels are four feet eight inches in diameter, and the front ones four feet; the breadth of the wheels is six inches; they are nearly upright, but not cylindrical. The iron tire when put on, weighs on the fore wheel 285 lbs., on the hind ditto, 336 lbs., making 621 lbs. When removed, the weight is, on the fore wheels, 144 lbs., on the hind ditto, 168 lbs. making 312 lbs.; wear in five months, 309 lbs. The number of miles travelled in this time is 6,048; the shoes that are put on the horses employed to draw this wagon, weigh, when new, from two pounds and a half to three pounds each; the average of a great many gave two pounds and three quarters, and when removed one pound and a quarter. They last from four to six weeks, according to the weather, and state of the road; but we may assume five weeks as an average, and the wear in that time for each horse six pounds, and for fifteen horses for five months it would be 360 lbs. The proportion, in this case, would be as 309 to 360, or as 1 to 1.16, or nearly one to one and a fourth on the generality of roads: therefore I would say the proportion of injury would be nearly as follows, when travelled by fast coaches—

Atmospheric changes, ...	20
Coach wheels, ...	20
Horses' feet that draw them, ...	60
	100

And when travelled by wagons—

Atmospheric changes,	20
Wagon wheels,	35.5
Horses' feet that draw them,	44.5
	100

"What is the effect of travelling by coaches and horses? whence, and in what proportion, does the injury or deterioration arise; is it from the crushing of materials; their actual wear; their displacement? If the wheels of carriages be properly constructed, and cylindrical, the friction, and consequently the wear on the surface of a well made road, will be very little, and there will be no injury from displacement of materials, except what may arise from the few surface stones that will sometimes be started out by the feet of horses on steep hills, when they are obliged to exert a great force to draw up a heavy load. When stones are thus thrown out on a hard and solid surface, the wheels of heavy carriages will crush them, and cause an injury which would be much more than that caused by the actual wear of the wheels passing over the surface. If the road be weak, or elastic, and bend, or yield, under the pressure of the wheels, the particles of which it is composed will move and rub against each other, or perhaps break by the action of heavy wheels over them. On such roads, I conceive the injury caused by steam carriages will be much greater in proportion to the injury caused by light carriages drawn by horses, than it will be on solid firm roads. In one instance, where an accurate experiment was made, the wear was found to be four inches of hard stone, when it was placed on a wet clay bottom, while it was not more than half an inch on a solid dry foundation, (formed as described in the report of the select committee on the Holyhead road, on the 30th May, 1830,) or with a pavement bottom, on a part of the same road, when it was subject to the same traffic. On the Highgate archway road, before mentioned, the annual wear does not appear to be more than half an inch in depth. Now, as this road is very little affected by wet, in consequence of its peculiar construction, and the care bestowed on its drainage, I attribute almost the whole of the diminution of materials to actual wear. On many roads, where the sides are weak, great injury arises from the crushing of materials, particularly by the action of wagon wheels. In frosty weather weak roads very frequently suffer more in one month than during all the rest of the year. In such cases, the injury is caused by the wheels of carriages, and not by horses' feet."

"The details of various kinds of steam carriages have been given to the committee; all act without propellers; without projections on the wheels; with cylindrical wheels; some with greater or less breadth of tire, even six inches wide; the power is applied either by crank or wheels to one or two propelling wheels, accordingly as greater or less force may be required. Some of the experimental carriages had three, some six wheels; all will have four wheels. Some have the engines in a separate carriage, and draw the load; some carry the load and engines on one carriage. Taking the above circumstances into consideration, which would be most injurious to a road—a stage coach, drawn by four horses, weight of coach three tons, horses two tons, breadth of tire two inches and a half; or steam coach, wheels four inches tire, weight four tons; in both cases velocity ten miles per hour? Taking for granted that the injury which a road sustains by the wheels of carriages, and the feet of horses is proportional to the wear of iron on the wheels and on the horses, and that the statement before given as to the actual wear on each be found correct, I would say the injury done to the road by the steam carriage weighing four tons with four inch wheels, would be less than that occasioned by the coach weighing three tons, drawn by four horses."

"Would it be beneficial, or otherwise, to the roads, that steam carriages, drawing heavy weights in carriages attached to them, should be substituted for wa-

gons drawn by horses, supposing that the weight of the drawing or propelling carriage should not in any case exceed the weight of the number of horses that would have been used to draw a corresponding weight, *e.g.*"

Wagon, - - - - -	8 tons.
Eight horses, 15 cwt. each, - - - -	6 ditto.
	14
On steam carriage, - - -	4
Carriage drawn, - - - -	10
	14?—

I am of opinion, that if the steam carriage and its accompanying carriage be constructed with wheels of a proper width, and of the same diameter as the wagon wheels, and travel with the same velocity, that the injury on well made solid roads will not be more than that caused by the wagon and horses: in fact, if the proportion of injury before stated be correct, it will be less; but it must be recollected that weak roads suffer more than solid ones from the heavy pressure of wheels, and, in such cases, the steam carriage and its tender would be more injurious."

"In descending hills, steam carriages can regulate their velocity by reducing the action, or number of revolutions, of the wheels; this acts as a drag, but with this advantage to a road, that the wheel moves continually round: which would be most injurious to a road, the descent of a carriage dragged as usual (not omitting the operation of horses' feet,) or the steam carriage dragged or regulated in the mode described? Not having seen a steam carriage descending a hill in the manner described, (that is, regulated by the action of the engine on the wheel,) I cannot give a satisfactory answer to this question; but, as far as opinion goes, I should say that the joint action of the horses and drag would be more injurious than the steam carriage, the motion of which was regulated in the above manner, provided the wheels were of the proper width, and the total weight not greater than that of the coach and horses."

The plan of tolls proposed by Mr. Macneil is given in the following extract.

"The toll which carriages propelled by steam, or by any other mechanical means, should be required to pay, ought, in my opinion, to be in proportion to the injury they would do to the roads compared with that done by the present description of carriages, and the horses employed to draw them, without reference to the weight or quantity of goods carried; but, as I before stated, I do not believe an accurate estimate can be, at present, formed as to the injury that roads may sustain from steam carriages, compared with the injury done to them by coaches drawn by horses. It may, however, I think, be safely assumed that the injury done to a road by a steam carriage would not be greater than that occasioned by a stage coach drawn by horses, the weight of the engine and its load being supposed not to weigh more than the stage coach, together with its load and horses. If this be granted and an act passed limiting the width of wheels in a certain proportion to the weight carried, there would not be much difficulty in arranging a scale of tolls applicable to steam carriages, which would put them on an equitable footing with carriages drawn by horses. If, for instance, a proportion, such as I have already mentioned, be adopted, viz. that a wheel should be an inch in width for every five cwt. it has to support, and a toll charged for each inch equal to the amount charged for a horse drawing in a carriage which travels with the velocity of the engine, it would, in my opinion, be a fair and equitable toll, at least for some years, or until a correct proportion of injury was ascertained by experience and observation, when it might be altered or amend-

ed according to circumstances. This mode of charging toll would be extremely simple, and not likely to be misunderstood by toll-collectors, or to occasion any disputes; but there should be a heavy penalty attached to the proprietors of steam carriages if they put a greater weight on the carriage than the wheels were intended to carry. If the engine, instead of carrying the load, draws one or more carriages after it, the toll should be collected and charged on each carriage in a similar manner as it is charged on the engine, that is, in proportion to its wheels. An example will illustrate my meaning more clearly: suppose an engine, together with its load, to weigh nine tons (which is about the average weight of two stage coaches, including the weight of the horses which draw them) to pass through a toll gate where horses drawing coaches are charged 6d. each, the toll on the two coaches, would be 4s., and of the steam carriage 4s. 6d. Suppose that the engine, instead of carrying the load, draws a carriage after it, and that the weight of the engine is five tons, with five inch wheels, and of the accompanying carriage four tons, with four inch wheels, the toll of the engine would be 2s. 6d., and of the tender 2s., making 4s. 6d. as before. The only objection I can see to this mode of charging toll on steam carriages travelling over the turnpike roads, would be, that, in the event of their being able to carry a greater number of passengers at a cheaper rate than the present description of carriages drawn by horses, it would lessen the amount of toll collected, as a fewer number of carriages would do the work, and many persons who drive their own horses would travel by them if found cheaper to do so; and this circumstance, although it would not affect the state of repair in which the road was previously maintained, might lessen the value of property invested in the different turnpike trusts throughout the kingdom, which is a very considerable sum; but such circumstances should not militate against an invention likely to prove beneficial to the country at large."

Mr. Macneil states that he saw Mr. Gurney's steam coach carrying eight or ten persons over one of the worst roads "in the country," at the rate of five or six miles an hour; he saw several horses both under the saddle and in harness pass Mr. Gurney's carriage without noticing it.

Mr. Macneil is of opinion that no road should have an ascent greater than one in thirty (about two degrees,) or one in thirty-five, and that the expense of such roads would be saved in a few years in the diminished labour of transport. The ascents between London and Birmingham are given as sometimes one in fifteen (about three and two-thirds degrees.)

The testimony of Col. Torrens, a member of the committee, and the last witness examined, is directed to the effect which would be produced upon the agricultural interests by the substitution of steam power for horse power. Upon such a subject there is much room for speculation, and we consider the analysis of this report as terminated without adding one more to the speculative opinions for which this new subject has already given room.

B.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN MAY, 1832.

With Remarks and Exemplifications, by the Editor.

(Continued from p. 333)

36. For *Fastenings for Bedsteads, Sofas, &c.;* John P. Allen, Manchester, Essex county, Massachusetts, May 19.

The nature and antiquity of this invention will be rendered appa-

rent by the claim, which is to "the application of the right and left hand iron screw to bedsteads, sofas, and couches, for the purpose of fastening together into solid frame work." We have neither time nor inclination to ascertain how many patents have been issued for putting bedsteads together by right and left handed screws, but recollect several; in some of them it is proposed to make the screws of wood, and in others of brass. Whether or not *iron* has been mentioned we cannot say; and, if not, the present patentee has the "forlorn hope" of sustaining his claim, by a strong material, it is true, though not by any thing which he has *invented* or *discovered;* he having merely substituted one well known material for another, which attains the same end, and by the same means.

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37. For a *Machine for Cutting Laths;* Ira Carpenter, Cincinnati, Hamilton county, Ohio, May 21.

This machine is described with sufficient clearness, but the drawing which accompanies it is unworthy the name.

Two methods of constructing the machine are mentioned, in both of which the cutting knives are made to revolve. According to the first, or main plan, a quadrangular frame is to be made by joining four pieces of timber strongly together; this frame is to be hung by a shaft, or pivots, passing through the middle of its sides. Across one, or both, of its ends a long knife, say one of four feet, is to be fixed, and by this knife boards are to be cut into laths. The frame is made to revolve by means of whirls on its shaft; the cutting knife is to have such a curve on its outer side as is due to the circle in which it revolves, and the inner side is to be made concave, having regard to the necessary strength. The cutting edge is not to be straight, but hollowed, so that when its ends come in contact with the board, its middle may stand at a distance of two inches. The knife should be from three to five inches in width.

The board to be cut is placed upon a suitable bed piece, with which the knife, in its revolution, comes nearly into contact. The board is made to advance against a stop, which gauges the thickness of the lath, being forced up by a rack.

The second method of forming the machine is to take a beam of about nine feet in length, and to hang it so that it may revolve upon a shaft, or gudgeon, passing through the middle of it. Along each of the ends of this lever a knife is bolted, of sufficient length to cut a lathe. These knives may, in this case, be straight on their edges, and may be made to cut at one end first.

The claim is to the construction of the concave and convex knife, and its application as described; and also to the combination and application of the other parts to the purposes set forth.

On the 16th of March, a patent was granted to Simon Willard, of Cincinnati, for a machine in most points similar to this, the main difference being in the concavity of the knife. See p. 163.

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38. For a *Washing Machine,* called the double cylinder wash-

ing machine; John S. Pulsifer and Ebenezer Pulsifer, Ipswich, Essex county, Massachusetts, May 21.

This machine is so truly a counterpart of that patented by Mr. Simon Savage, on the 11th of April last, and described p. 236, that we shall merely refer the reader to the account there given, for a full display of the present invention.

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39. For a *Stereotype Block;* Bradbury Hackett, Boston, Massachusetts, May 21.

This is entitled an improvement in moving forward the *hookers* of the stereotype block.

The two moveable hookers have shanks to them, which are placed in excavations made for the purpose, in the block. These shanks are surrounded by a spiral spring, which may be made to act in either of two ways; it may force the hookers against the edges of the plate, so as to hold it by their continued pressure; or it may force them from the plate, and be kept up against it by the action of a cam, or turnbuckle, against a plate of brass, by which they are connected. The drawing represents the former arrangement. There is a cam, or turnbuckle, which, when a key is inserted, acts upon the middle of a piece of brass, the ends of which force the hookers against the plate, the cam being retained in its place by the falling of its end into a slight depression on the brass plate. We should think the first described arrangement the best, as the distance to which the hookers are carried cannot, by this latter mode, be varied by the spring, and is not, therefore, so well adapted to any difference in the width of a stereotype plate.

Instead of using the spiral springs, it is proposed sometimes to substitute a bar of steel for that of brass, giving to it such a form and thickness as shall cause it to serve the double purpose of lever and spring.

The claim is not to the individual parts, but to the general arrangement of them for the purpose to which they are to be applied.

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40. For a method of *Attaching Leather Soles to Boots and Shoes of India Rubber;* Wait Webster, city of New York, May 21.

An in-sole of leather is to be put within the shoe or boot, and a corresponding out-sole and heel are placed on the outside, when the whole is to be attached together by nailing, pegging, or sewing, in the ordinary modes of performing these processes.

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41. For a *Machine for Sawing Timber;* Jackson Blood, of Trumbull, and Samuel A. Hurd, of Huntingdon, Fairfield county, Connecticut, May 22.

What is intended for a description of this machine does not explain either its construction or mode of operation; and the drawing, although it is good as a picture, is very far from supplying the defect of the specification. It appears, however, that saws are to be

stretched in a saw frame, and that this saw frame is to work horizontally within the general frame work of the whole apparatus. A horizontal shaft, with its proper gearing, crank, and pitman, is to vibrate the saw frame. The timber, according to appearances, is to be placed, by some means, under the saw, the frame of which, as the teeth enter, is to sink down upon it. The thing, as represented, appears to be altogether incapable of being worked, and will, in this case, be secure from all successful attempts at piracy.

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42. For a *Machine for pressing, fluting, and bending, Tortoise Shell, Horn, and other Combs;* Reuben Munson, city of New York, May 22.

We looked for some new kind of press to be described in the specification of this patent, but found nothing more than a common hand screw press for forcing convex and concave, or other dies together. The patentee, however, says that the dies, or moulds, are a material part of the "*invention;*" of the *apparatus*, he should have said, as we usually apply the term invention, in the way in which it is here used, to those things only which are supposed to be new; a supposition which no one can, in the present instance, entertain, who is in the slightest degree acquainted with the various manufactures of tortoise shell, horn, &c.

It would be difficult to ascertain at what period it was *not* known, in Asia and Europe, that "horn or shell, annealed, or softened, in hot oil, or other liquid, or in any other convenient way, and pressed" into moulds, would receive, and, when cold, would retain, the impression of the mould, yet for doing this, and precisely in this way, the present patent is taken. We had occasion two or three years since to notice the obtaining of a patent for the same purpose, and then spoke of the entire want of novelty in the alleged invention.

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43. For an improvement in the *Blast Furnace for Smelting Iron Ore;* Thomas Gregg, Connelsville, Fayette county, Pennsylvania, May 22.

The interior of this furnace is to be circular, and three feet in diameter at the boshes, widening out to three feet six inches at the tunnel head. Within the body of the stack there are to be two air flues, which are to create a draught for two small furnaces on one side of the superstructure, which are called generating furnaces. The flame created by these furnaces is to be brought into contact with the blast at the tuyere, in order to produce ignition at that part in which the force of the issuing blast ordinarily prevents it, and in this way to obviate the collection of cinder, which usually proves so troublesome by adhering around the tuyere.

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44. For an improved *Printing Press,* denominated the "Faustus Printing Press;" Seth Adams, Boston, Massachusetts, May 23.

We shall not attempt to describe the manner of arranging the va-

rious parts of this press. The patentee claims "the combination of the crank, the cam, and other parts together, so as to move the platen, or frisket, and produce the effects described." The press is to be operated upon by hand, a handle being attached to a fly wheel for that purpose, as in several other presses.

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45. For a *Smut Mill;* Stephen Fellows, Sandwich, Stafford county, New Hampshire, May 24.

A wheel of about eighteen inches in diameter is made to revolve vertically in a suitable frame. This wheel has upon its edge, a rim or hoop of sheet iron, which projects over on one side in the manner of the rim of a sieve, and is perforated with holes to allow smut and dust to pass through. Nails, or pins, are driven into this wheel, and project about an inch from it. They are so driven as to form concentric circles about an inch and a half apart. This wheel revolves against a stationary board, a little larger than the wheel, and having nails, or pins, also driven in circles, occupying the spaces between the circles on the wheel. The stationary board is perforated at its centre, so as to form an eye through which the smutty grain is to be fed. Appended to the apparatus is a hopper, and suitable riddles for feeding and separating the grain, and a fan for cleaning it.

The grain, in passing from the centre to the circumference of the revolving wheel, is operated upon by the projecting pins, and also by the rim with its perforations, which cause it to be rough within. The claim is to the wheel and fixed board, with the pins arranged in the manner described.

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46. For an improvement in the *Apparatus for Baking or Roasting*, usually called the reflecting tin baker; William Prescott, Boston, Massachusetts, May 24.

This is confessedly the common tin kitchen, but an improvement in it, is claimed, which consists in placing the pan or trough which collects the gravy close to the front, and allowing the lower part of the kitchen to slope forward so as to carry all which falls upon it into the trough. This constitutes the invention, and forms the subject of the claim.

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47. For an improvement in *Bedsteads;* Bethel Judd, New London, New London county, Connecticut, May 25.

The bedstead is to be made and put together in the common way, the new invention consisting in an ancient mode of stretching the sacking bottom. To effect this it is to be nailed to loose rails which slide by means of tongues fitting into grooves in the head and foot rails. Screws passing through the side rails of the bedstead, work in nuts let into the slide rails, and serve to tighten the bottom. A short rail, or rather a block, according to the drawing, is to be attached to the head and the foot end of the sacking, a single screw through the head and foot rails working into each.

In the old English fashion, a single sliding rail was used at the

head only, with screws passing into it through the head rail, and thus drawing the bottom lengthwise, whilst it was corded at the sides. We have heard English cabinet makers say that were they to return to England, they would introduce the American fashion of cording upon pins, as being preferable to any other. When the sacking is nailed to a rail, as in the plan of the patentee, it forms a secure harbour for bugs, as is well known in our common cots. The screw holes also offer inviting retreats to the same unwelcome bedfellows, and abstract very much from the commendation which any one might otherwise be inclined to give to such a mode of tightening sackings.

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48. For a *Sector Tonsillarum*, being an improvement in surgery; William B. Fahnestock, Lancaster, Lancaster county, Pennsylvania, May 25.

The form of this instrument is that of a stem, or shank, of a fifth of an inch in diameter, with a ring on one end of about an inch and a quarter in diameter. The stem is perforated from end to end, to allow a rod, or wire, to pass through it, which rod, or wire, is furnished with an ivory handle at the end opposite to the ring. The ring is split through its plane, and the split, or kerf, extends up the shank a distance equal to the diameter of the ring. A piece of steel plate is made in the form of this ring, with a rod, or wire, projecting from it of sufficient length to pass through to the upper end of the shank, and receive the ivory handle. When these are all in their places, the three thicknesses of which the ring consists, coincide. The inner edge of the lower half of the steel ring is made sharp, and when it is desired to remove a tonsil, or other soft part, the ring is passed over it, and the ivory handle being drawn forward, it is separated by the cutting edge.

The patentee states that the ring may be made to consist of two parts only, one sliding upon the other, but that he prefers the former method.

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49. For *Machinery for washing and cleaning Paper Makers' Felts;* Samuel E. Foster, Brattleboro, Windham county, Vermont, May 25.

A hollow cylinder of metal, from four to ten inches in diameter, is to be perforated with holes over its whole surface, its length must of course be such as will adapt it to the machine in which it is to be employed.

The felt is to be made to pass round this cylinder, and is to be borne against it by smaller rollers of wood, and so secured by boxing that but little water shall escape from the perforated roller without passing through the felt. Two other wooden rollers serve to squeeze the superfluous water out of the felt, as it passes between them. Steam may be applied when requisite for the purpose of rendering the felt pliable. The water, or the steam, is to be introduced through hollow gudgeons at each end of the perforated roller.

50. For a *Washing Machine;* Ezra Fisk, Fayette, Kennebeck county, Maine, May 25.

A vibrating rubber, composed of fluted pieces and of rollers, is to operate upon the clothes so nearly in the manner of many other washing machines, that we think a particular description of this, is unnecessary. The patentee considers it as a very superior article, and should the public concur with him in opinion, their praise will be of more value to him than any we are prepared to bestow.

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51. For a *Filtering Machine to be used in the art of manufacturing Paper;* Thomas French, Ithaca, Tompkins county, New York, May 26.

This machine is to perform the task of what has been usually called a pulp dresser, some of which instruments we have formerly described. A cylindrical vessel of copper, or of brass, is to be made with slots, or openings from top to bottom, exhibiting the appearance of bars about one-fourth of an inch wide, and one thirty-second part of an inch asunder. It may be made solid, and afterwards cut in this manner, or it may be composed of metallic bars put together. It may also vary in its form, being either square, polygonal, or otherwise. Its diameter may be fifteen, and its height fourteen inches.

A perforated dasher is to be made to play up and down in this vessel, by means of a crank, giving a velocity of from five to six hundred strokes in a minute. The pulp admitted into it is thus forced through between the bars into a vat below, whilst the knobs, &c. are retained, and are removed, when necessary, through a suitable opening. The rim of the dasher stands about half an inch from the sides of the cylinder, and in its vibration approaches the bottom within half an inch, and the top within four or five inches. To supply the cylinder with stuff, a conductor of the requisite size passes through the top, or cover, of it.

The cylinder is enclosed within a close, square box of wood, and one which has been made of the given dimensions, supplies a machine vat which works the pulp beat by two engines. The driving power is said to be equal to about that of a man. If the metallic vessel is made sufficiently strong, so that the bars will not yield to the pressure, the necessity of picking the paper after it is dried, is said to be obviated altogether; whilst, from the agitated state in which the pulp is thrown into the vat, the fibres are more perfectly entangled than is general in machine paper, and it is thereby improved in quality.

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52. For a *Washing Machine;* Ebenezer Mayo, Hallowell, Kennebeck county, Maine, May 26.

A drum, or hollow cylinder, which we suppose may be about two feet in diameter, is hung so as to turn vertically in a tub, or trough, the lower edge of the cylinder dipping into the soap suds contained in it. A smaller cylinder, one-fourth or one-fifth the diameter of the former, either plain or fluted, is placed above it, and is caused to revolve by it, the large cylinder is turned by a winch, and the small

one is made to bear upon it by springs operating upon its gudgeons. The large cylinder is generally covered with slats placed at a small distance from each other; upon this the articles to be washed are laid, being confined to it by hitching some string, or other small part, between the slats, or otherwise.

It is recommended, in order to prevent the splashing of the suds, to enclose the whole in a box, which must be furnished with a door on one side to inspect and regulate the operation.

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53. For a *Horizontal Water Wheel;* Sheldon Stoddard, Jackson, Susquehanna county, Pennsylvania, May 28.

We have here a very imperfect kind of wheel, described with corresponding vagueness. The drawing, however, shows enough of its general construction to prove that it is not new in principle; and as similar wheels have been often tried, we are well assured that it will convey as little of the power of the water to the mill as any wheel well can. The buckets are hung in the manner of doors, or shutters, which are to open and present their broad sides to the current on one side of the wheel, whilst they are to swing and present their edges on the opposite side. Buckets of this description always appear to be very perverse things when set to work, refusing to open at the period set down for them, and thus losing a great part of the time in which it is intended they should labour.

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54. For a discovery in *Bleaching Cotton, Linen, and other Cloth;* John B. Greene, Portsmouth, Rockingham county, New Hampshire, May 29.

This discovery consists in first impregnating with alkali the cloth to be bleached, and then subjecting it to the action of chlorine gas, in a suitable apparatus. The alkali, it is said, protects the cloth from injury by the gas; it is afterwards to be cleaned in any of the known ways, and passed through a weak solution of sulphuric acid.

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55. For *Rendering Fish Oil Drying;* David C. Knapp, Charles K. Knapp, and Allan H. Howland, Oswego, Oswego county, New York, May 29.

The patentees claim "the preparing and manufacturing the aforesaid oils by chemical agents, in such a manner as shall cause them to dry, and render them fit and proper for all the purposes of painting and glazing, to which linseed oil may be applied.

The mode of effecting this is to boil the oil with litharge, red lead, white lead, white vitriol, or other metallic oxides, or salts. The quantity of the oxides being proportioned to the time in which it is wished that the oil should dry.

Fish oil has been rendered drying, and used for the purpose of painting, many years since. We published a description of a mode of doing this in the first volume of the Franklin Journal, in June, 1826, which we extracted from a volume of the Transactions of the

Society for the Encouragement of Arts, &c. published some years earlier. The recipe there given is as follows—

In refining 252 gallons (one ton) of fish oil, there will be used thirty-two gallons of vinegar, twelve pounds of litharge, twelve pounds of white vitriol, twelve gallons of linseed oil, and two gallons of spirits of turpentine. The drying ingredients are first to be added to the vinegar, and well mixed with it, by agitation, twice a day for a week. This is then to be added to the whale oil, well mixed, and is to be allowed a day to settle, when it is fit to be poured off, and to have the linseed oil and turpentine added to it. Colours prepared with it are said to be bright, and more durable than those used with linseed oil.

It appears, therefore, that the claim to the rendering of fish oil drying by means of chemical agents, is one the novelty of which cannot be sustained.

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56. For *Apparatus for Cooking, and for Heating Rooms;* Jacob Stahl, city of Baltimore, May 29.

There is not much pretension made to invention in this patent, the merit of the apparatus being said to rest upon the particular arrangement of its respective parts. It consists of a stove made of cast and sheet iron, with an oven, in the usual form for cooking, and dampers for regulating the flues. The flues, or pipes, for heated air, are made double, and the space between them is filled with pulverized charcoal, or other bad conductor. When the weather is warm, and the oven is used for cooking, the heat passes off by a short flue; when the heated air is required for warming rooms, a long pipe with elbows, operating as drums, is employed. The claim made is to the particular construction of the apparatus.

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57. For a *Metallic Stereotype Block;* Samuel Sawyer, Boston, Massachusetts, May 29.

(See specification.)

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58. For an improvement in the *Box and Hub of Wheel Carriages, and in the method of Hanging Coach Bodies;* David Watson, Fayette, Kennebeck county, Maine, May 29.

Boxes are to be made of cast iron, of the usual form on the exterior, but with a rebate at each end in the interior, so as to receive a copper ring, cast for the purpose, which is to be five-eighths of an inch deep, and three-fourths thick. These rings are driven in against a shoulder on each end of the cast iron box, and are secured by rivetting; they form the bearing for the axle, the bore of the cast iron between them being such as to allow a space of three-eighths of an inch between it and the axle.

A hole is to be bored through the hub and the iron box at the middle of the axle, for the purpose of supplying oil. A sponge is to be placed in this hole to retain the oil and lubricate the axle, and it is closed by means of a screw, to prevent the entrance of dirt and water.

In hanging carriage bodies, the first improvement described is the putting of steel rollers three inches long, and an inch and a quarter in diameter, at the upper ends of the jacks, over which the thorough braces pass. Under the body of the carriage, and extending from one end of it to the other, over, and in the direction of, the perch, an elastic beam, or strip of wood passes, which is three inches wide, and an inch thick, and this is connected on its under side to levers, by strong spiral springs, which are arranged in a way which could not be clearly explained without the drawings, but which are intended to give the most perfect elasticity to the whole structure, and are, it is averred, capable of being so managed as to cause the passenger to ride with equal ease, whether a stage be loaded lightly or heavily.

The claim is to the copper rimmed boxes, and the mode of applying them; the adaptation of the iron boxes to them; the mode of supplying the oil; and the described manner of hanging the bodies of stages, or other carriages.

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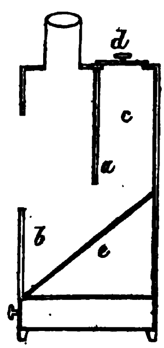
59. For an improvement in *Stoves for Burning Anthracite Coal;* Jordan L. Mott, city of New York, May 30.



The improvement here proposed, consists in dividing a stove into two parts by a partition which reaches to the top plate, but does not descend to the bottom of the stove, as is shown at *a* in the section in the margin. The fire is to be lighted at *b* in the usual manner; the part *c* is to be filled with coal, and the cover *d* placed on, which will give a continued supply of fuel by the descent of the coal down the inclined plate *e*, as that in the front is consumed.

The claim is to the dividing of the stove, and the fixing an inclined plate, and grate, for the descent of the fuel.

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60. For an improvement in the *Silk Reel;* Charles G. Green, Windsor, Windsor county, Vermont, May 30.

The improvement here described is intended to distribute the silk upon the reel with perfect regularity, and thus to prevent the occurrence of the defect which is known by the name of glazing; and consequently to produce silk of a better quality than can be obtained by the common reel. To effect this purpose the reel is made to traverse backward and forward with perfect regularity; this is done by lengthening out the gudgeons of the shaft of the reel, so that they shall each form cylindrical rods of the full length of the reel itself. These turn in boxes upon the frame of the reel, having a crank upon one of them for that purpose.

These rods may be about an inch in diameter, and upon one of them two channels are cut from end to end, one of these forms a right, and

the other a left handed screw. A guide piece in one of the boxes, acting alternately in these grooves, causes the reel to traverse backward and forward. This is the part which forms the subject of the patent, it being the only one in which this reel differs essentially from others.

As there are two cylindrical rods, we should suppose that it would be better to have the right hand screw on one of them, and the left hand screw in the other; as in the machine described, these grooves cut each other in their crossing, at every turn. The principle of action would remain the same, although in the case suggested each box must have its guide piece, which could be engaged and disengaged by very simple gearing.

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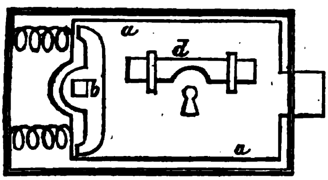
61. For *Spring Catches or Locks for Doors;* Robert J. Byram, Boston, Massachusetts, May 31.



We cannot give the precise structure of this lock without a more lengthened description than we can allot to it. One of its principal features, however, is the making the bolt in such a way that it forms a frame, the rim of which slides against the sides of the box of the lock, as seen at *a a*. The tumbler *b*, standing in the centre of this, draws the bolt back, which is forced forward by the spiral springs *c c*. A small bolt, *d*, shooting against the frame, may serve to lock the door. The patent is taken for these and certain other particular arrangements.

Specifications of American Patents.

Specification of a patent for a Metallic Stereotype Block. Granted to Samuel Sawyer, *Boston, Massachusetts, May* 29, 1832.

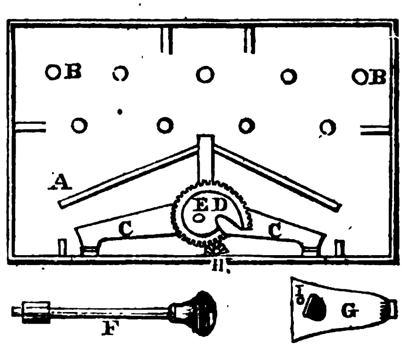
To all whom it may concern, be it known, that I, Samuel Sawyer, of Boston, in the state of Massachusetts, have invented a new metallic stereotype block, to be used for the purpose of holding stereotype plates in the process of printing, and that the following is a full and exact description of my said invention.

Instead of forming the stereotype block of wood, in the usual way, I make it of metal, hollow on the underside, and generally cast in one piece, either of iron, brass, type metal, or any other suitable metal, or mixture of metals. Instead of being cast, however, they may be made of sheet metal, in the manner of the iron boxes of common door locks. To support the face plate, or that upon which the stereotype plate is placed, I cast, or otherwise affix within the block, studs, or partitions, of metal, sufficient in number for that pur-

pose, and extending down from the inside of the face plate, so as to bear upon the platen when on the press.

Upon one edge of the face of the block, I cast, or otherwise affix, permanent clasps, or catches, of the usual form for holding the plate; and through openings in the face of the block, at the opposite edge, project the moveable clasps, or catches. These moveable catches, which work through slots or mortices in the face plate, are attached to, and make part of, a metallic plate placed within the block, and sliding against the under side of the face plate. In order to force the catches against the edge of the stereotype plate, I employ an eccentric or spiral wheel, having on its periphery cogs, or teeth, which wheel is acted upon by a key passing through an opening in the edge of the face plate, between the two moveable catches. This key is furnished with teeth, which, taking into those on the edge of the eccentric or spiral wheel, enable the operator to force up or retract the catches at pleasure. The principle upon which this eccentric, or spiral wheel, operates, will be more clearly shown by a reference to the drawing thereof deposited in the patent office.

What I claim as my invention, and for which I ask a patent, is the using of a metallic stereotype block, constructed in the manner herein described; and also the manner in which the moveable catches are operated upon by a key, and an eccentric or spiral wheel, as above set forth, whether the same be made in the exact form represented, or in any other operating upon the same principle, and producing the same effect.



A, under side of the block.
B, B, studs.
C, metallic plate carrying the moveable clasps.
D, spiral toothed wheel, turning on the pin E.
F, key for turning the wheel, and moving the catches.
G, plate which covers the wheel.
H, stop which acts against a rim on the spiral wheel, bearing it against the key.
I, hole for the point of the key.

Specification of a patent for a Pulp Dresser for the purpose of separating the knobs, or grosser particles, from the pulp used in the manufacturing of Paper. Granted to Coleman Sellers, *city of Philadelphia, June* 6, 1832.

To all whom it may concern, be it known, that I, Coleman Sellers, of the city of Philadelphia, in the state of Pennsylvania, have invented a new and improved pulp dresser, for the purpose of separating the knobs, or grosser particles, from the pulp, in the manufacturing of paper, and that the following is a full and exact description of my said invention.

I form a pulp wheel, or dresser, which is made to revolve within the machine containing the pulp, by the application of power in the ordinary way. Fig. 1, in the accompanying drawing, is an end view of the wheel, or dresser, the opposite end being in the same form, and the two being connected together by plates of brass, or other material, which form a complete casing thereto. This wheel, or dresser, is represented as carrying six dressing plates, to be presently described, but this number may be varied as may be found convenient. Fig. 2 is a perspective view of the wheel, showing the plates which pass from end to end, one half of which are plain, and the others so perforated as to form the dressing plates, or strainers, for the pulp. The plates which are perforated to form the strainers I generally place so that their planes form radii with the centre, or axis of the wheel as seen at A A in the drawing. The plane, or unperforated plates, may, at their junction with these, at B B, form a right angle with them; but the form of the plates, and the angles at which they stand, may be varied, without changing the principle upon which they operate. Instead of making the plates flat, they may, for example, be bent so as to form a curve from their exterior to their interior points of junction, as shown by the dotted line C C, fig. 1.

The lines drawn upon the plates A A, fig. 2, represent slots, openings, or perforations, cut through those plates, and forming them into strainers, which allow the finer portions of the pulp to pass through, and arrest the knobs, or coarser particles. These perforations may differ in width, according to the kind of paper to which the dresser is to be applied, but I sometimes make them so that they can be graduated, and the same wheel, or dresser, answer for every kind required. This I accomplish by making the plates double, and perforating them so that when laid upon each other the openings through the two plates shall exactly coincide. By sliding one plate upon the other, by means of a regulating screw, or otherwise, they may then be readily graduated.

D, fig. 2, shows the shaft by which the wheel, or dresser, may be made to revolve. One of the heads of the dresser is open, as at E E, and through this opening the pulp which has been cleaned from the knobs and coarser particles escapes; this end revolves in a hoop, or collar,

fixed in an opening in the side of the vat, or machine, in which the dressing is effected.

The most advantageous way of using this wheel, or dresser, is to fix it at such height in the machine as that when one of the plane or unperforated plates F F F F, is upwards, and horizontal, it shall coincide, or nearly so, with the line of the surface of the water; the machine, however, will work if entirely immersed, but not so advantageously.

The perforated faces of the wheel, or dresser, in its revolution, meet the floating pulp, and as they strike against it, the finer parts pass through to the inside, whilst the coarser are arrested; and at the same time, these coarser particles are prevented from accumulating on the surfaces of the strainers by the agitation produced by their striking against, or upon, the fluid.

What I claim as my invention and for which I ask a patent, is the use of a revolving wheel, or pulp dresser, which carries the dressing plates, or strainers, causing them to strike against the fluid containing the pulp, and allowing the dressed portion to pass through to the inside of the wheel, or dresser, acting upon the principle, or in the manner hereinbefore described, whether the same be made in the exact form represented, or in any other producing the same effect.

COLEMAN SELLERS.

Fig. 1.

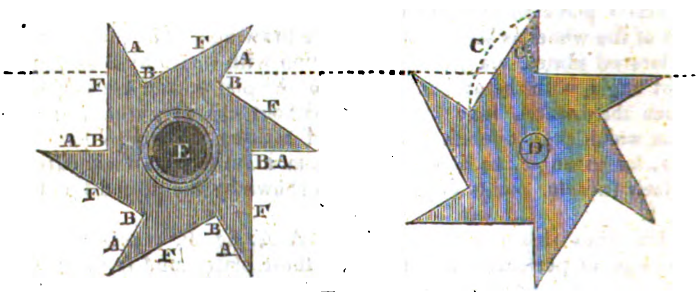
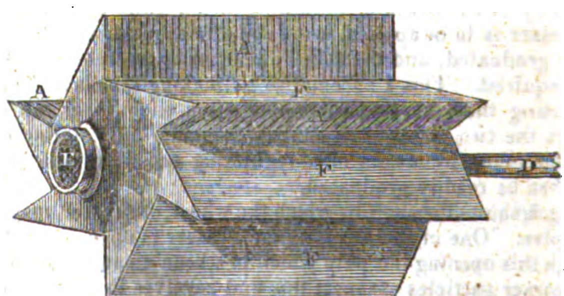


Fig. 2.

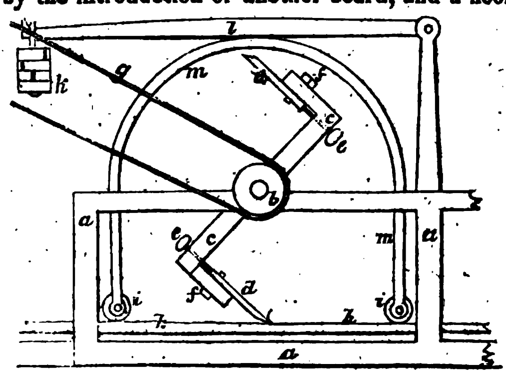


ENGLISH PATENTS.

Patent to M. MUIR, *Engineer, for improvements in machinery for preparing Boards for Flooring, and other purposes. Granted December* 22, 1831.

In the third volume of the present series of the "Register,"* page 65, we have described a machine, by this patentee, for performing at once the several operations of sawing, planing, grooving, and tonguing flooring boards, and his present patent is for an addition to the same, by which the boards are reduced to a uniform thickness, and therefore completed for laying on the joists. For this purpose the boards are laid upon their faces, or planed sides, and made to pass under a set of revolving adze cutters, by which they are reduced to uniform thickness. The annexed is a sketch of the revolving adzes, where *a a a* show a cast iron frame, with a pulley, or trigger, for giving motion to the cutters *b b*, which are connected with a horizontal axis by means of the rectangular arms *c c*; *e e* are adjusting screws, to regulate the depth of cut; and *f f* are binding screws, for securing the cutters when adjusted. *g g* show a band by which the motion of the steam engine, or other first mover, is transmitted to the revolving cutters. *h h* show the board to be acted upon, and *i i* are two rollers resting upon the board, and by means of the weight *k*, the lever *l*, and the bent frame *m m*, prevent the board from rising while under the operation of the cutters.

The boards are brought forward to the cutters by means of a chain passing over a drum situated where the frame is shown imperfect. From different links of the chain descend hooks, which hold the end of the board and force it forward as the drum revolves, and when the last end of the board is brought under the drum it is to be pushed forwards by the introduction of another board, and a hook from the



* Mr. Muir's patent, upon which this is an improvement, was obtained on the 1st day of June, 1827. It is described in the Register of Arts, as above, and also in the London Journal of Arts, vol. ii. second series, p. 68.

chain applied to the farther end of that, and so on in succession, during the operation of the machine.

The favourable opinion which we formerly gave of Mr. Muir's planing machine has been completely borne out by the success of the machine, and we have every reason for believing that the patent before us will prove an important addition to his former invention.

[*Reg. of Arts.*

Patent to T. J. Potts, R. Oliver, *and* W. W. Potts, *for an improved method, or process, of obtaining impressions for engravings in various colours, and applying the same to Earthenware. Granted September* 17, 1831.

The employment of a rolling press, to print the intended impression on a continuous web of paper, appears to be the principal object of these patentees. The paper on which the impressions are to be made, is first subjected to the process of sizing. For this purpose, an apparatus, consisting of a sizing trough, in which turns a feeding or supplying roller, over which is placed a sizing roller, both being covered with flannel or printing blanket. These rollers being turned till the flannel becomes saturated with size, a third roller is placed over them, and round this is coiled the web of paper, as it is sized by the pressure of the upper against the middle roller.

The upper roller, with the coil of paper upon it, is then removed to the printing machine. This consists, first, of a colour trough, with a roller to transfer the colour to a metallic cylinder, on which is engraved the design to be transferred to the earthenware, porcelain, glass, &c. To the surface of the engraved cylinder is applied a doctor, or scraper, consisting of a straight steel blade, extending all the length of the cylinder, straightened by pieces of metal, being screwed to each side of it nearly up to the edge, which is pressed against the cylinder by means of a lever and weight, to remove the superfluous colour. The engraved cylinder is made hollow, that its temperature may be considerably increased during the operation of printing, by passing steam through the axis on which it turns, while the colour in the trough is preserved in a fluid state, also by steam, for which purpose it is furnished with an exterior casing and communications from it to a steam boiler.

The paper to be printed is then to be passed through between the engraved cylinder and a pressure roller, by which process are transferred to it a series of impressions, as they have been engraved upon the cylinder. The paper is then to be cut into such pieces as may be required to be applied, to communicate the impressions to the earthenware, which part of the process is to be effected in the usual manner.

When it is necessary (as it is stated to be sometimes) to engrave the intended design on a flat plate, heat is to be communicated by placing the plate over a metallic steam box, instead of over a charcoal

fire in the usual way, and making it to traverse forwards and backwards by means of a crank and connecting rod, care being taken, by stuffing boxes, to preserve the communication between the steam boiler and heating box. [*Ib.*

Patent granted to John Cowderoy, *for manufacturing Bread and Biscuits. Dated October* 14, 1831.

This invention is to make bread on a large scale, or to prepare in a shorter time a greater quantity of loaves than manual labour can produce. There is a wooden vessel, tub, or trough, in which is first prepared the liquid matters which form so large a portion of our bread loaves. What these are, Mr. Accum has told us we ought not particularly to inquire into, if we would eat heartily. But setting aside all thoughts of dried bones pounded, alum, yest, potatoes, salt, water, &c. we will suppose the liquor prepared in this wooden vat, or trough. It has a large wooden cock near the bottom, which being open, its contents are issued into an inclined pipe, or channel, or conductor to the kneeding trough. Over this channel is a flour box duly prepared, attached to which is a drum, or cylinder, begirt with rows of brushes, or bristles, to temse or cleanse the flour, forcing it in equal quantities through a wire sieve, so as to make it mix equally, gradually, and completely with the liquor, in order to make a sponge in the kneading trough; it is then allowed to rise, and when the ingredients are added which are necessary to complete its doughy character, it is removed on a long rail-way to a part of the bread manufactory, in which is situated a large frame with a variety of moulds of different sizes and shapes. When the dough is thus made into loaves, or moulded into the prescribed form, it sets off on another rail-way journey, and is conducted safely into the oven in the way most conducive to its easy and speedy baking. When that time comes, the other end of the oven is opened, and an immense feather-edged peel, which moves on wheels, is introduced, and the huge baking is removed in large quantities, and at few batches, from the oven. The process is equally applicable to the production of biscuits, and the whole invention would have been attributed in ancient days to the direct influence and inspiration of the much worshipped deity *Jupiter Pistor.* What a grand accompaniment to the commissariat department of an army, or to the *provant* stores of a besieged garrison! [*Rep. Pat. Inv.*

Patent to J. Mabury, *and* J. Mabury, Jr., *for improvements in polishing and manufacturing Ladles, Spoons, and other articles of tinned iron. Granted January 24th,* 1832.

The application of a pair of planishing rollers, highly polished, and mounted in a manner similar to that usually adopted for flatting

rollers, constitutes the principal part of the improvements contemplated by these patentees. The tin plates are polished by being passed through between the rollers previously to their being formed into ladles, spoons, or other articles of culinary use. In stamping the polished plates into the forms for which they are intended, dies of the usual form, but of much finer finish, so as not to injure the polish of the plates, are to be employed. The articles are then to be finished in the manner usually adopted in completing the manufacture of spoons, ladles, and other culinary utensils.

[*Reg. of Arts.*

FRENCH PATENTS.

Patent granted to Monsieur Le Petit Lamasure, *Jr., Founder, at Rouen, and proprietor of the Forges in the Department of Lot-et-Garonne; for a double case furnace Tewel, supplied with water, and a moveable tube within, to regulate the current of air, for the purpose of economising the combustible and the workmanship; also to obtain a greater proportion of iron.*

General observations upon the inconveniences of ordinary Tewels, and of their position.

The most experienced manufacturers of iron have agreed that the inclination, more or less, in the placing of the tewel, is sufficient for obtaining a fourth, and sometimes even a third, less of the ore, than is procured when the same tewel, by its position, forms a strict angle agreeing with the vertical line that passes by the axis of the furnace.

But supposing that it be easy and convenient to place this tewel, so that the current of air be introduced into the furnace with every requisite advantage, we must admit that it will suffer no derangement or descension during the whole course of the operation, which we cannot allow; for upon this point, and up to the present moment, an imperfection has existed which involves the inevitable causes of the loss occasioned by these said tewels. In fact, after having bestowed much time and pains in the construction of a furnace, wherein scrupulous attention has been observed in properly disposing a tewel of the ordinary form and manufacture, it is no unusual occurrence to find it insensibly altering, and the mouth of the air-pipe changed in figure, and augmented—and this at every instant: a serious inconvenience, because the same quantity of air issuing by two orifices of different dimensions, and propelled by the same force (their relative speed being an inverse ratio to the orifices,) it follows that if the primitive orifice give vent to proper swiftness, and in a convenient direction, it is certain that the one which manifests deterioration will not fulfil the same functions: thence follows the necessity of replac-

ing the worn tewel, in order to make it perform the same duties, which is an operation at once laborious, expensive, and attended with difficulties, on account of the immense heat with which the furnace is impregnated not allowing of a near approach to it; besides which, there results a waste of time; a mass of combustible burned almost without effect; a decided loss of material in the produce, where a given quantity of iron was expected: and, finally, that iron of a bad quality is produced whenever the tewel has been burned.

Means of obviating the inconveniences which arise from the employment of the ordinary tewels.

The double tewel here represented was constructed to remedy the evils just described. This machine is not liable to deterioration upon being exposed to the violence of the fire, because it serves as a reservoir of water that is continually renewed; or, in other terms, because a small course of water passing between the double case, maintains it constantly in a state of freshness, and prevents it from being burned.

It will be seen that in constructing the furnace, after having properly arranged the tewel, it may be firmly fixed, because it will never be susceptible of being deranged from its place; for by means of a conical tube, similar to that of fig. 4, the dimensions of the orifice for the current of wind to be introduced into the furnace may be altered in a moment, according as the operation may require, whether to vary the speed, or the bulk; and this, too, without the direction of it in any case being changed.

By means of this new tewel with its reservoir of water and interior tube, the necessity of the workman is superseded, who is commonly employed the whole year round to repair and readjust the original machine, and who is usually hired at the rate of seven or eight francs a day.

The double case tewel is applicable to every description of tewel, no matter of what form or species.

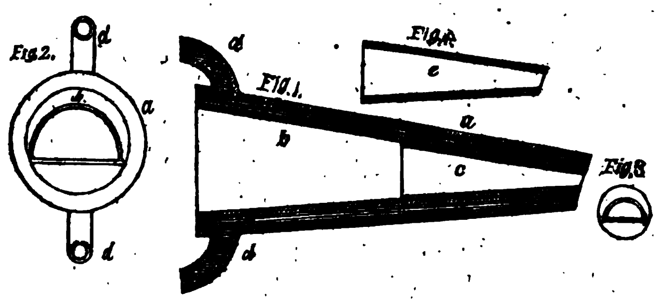


Fig. 1, longitudinal section of the tewel.
Fig. 2, end view in the quarter of the large opening.

Fig. 3, view of the extremity opposite to that of fig. 2.

A, exterior conical case, in brass.

B, interior case, of the same metal and form.

C, annular space reserved between the two cases *a b*, and containing water.

D D, pipes serving to introduce water into the space *c*, and to carry it off.

E, figs. 1 and 4, a small, simple tube, of a conical form, to be inserted at pleasure in the double tube, or tewel, *a b*, in order to graduate the quantity of air that is required to be introduced into the furnace, without any other derangement than that which is necessary to change this small tube for another, the orifice of which is conformable with the effect desired and expected.

[*Rep of Pat. Inv. from Brevets d'Inventions.*

Patent granted to Sophie Victoire Laine, *for a process for making Gelatine from Bones without muriatic acid, yielding a residuum which may be used as excellent nourishment.*

The beef and mutton bones used in this process are first cleared from the flesh, washed, and completely broken up. When so prepared the bones are placed upon the fire or exposed to steam, with a sufficient quantity of cold water, in an autoclave, or one of Papin's condensing coppers or *marmites;* the upper part being secured by an iron bar, with one or several screws.

The fire, or steam, is urged to a considerable degree for several hours, until the time that the water in the copper, or marmite, has possessed, by ebullition, the whole of the gelatine contained in the bones: after the fire, or steam, has ceased to act, and when the phosphate of lime, entirely deprived of gelatine, is precipitated to the bottom of the vessel, the liquor is drawn off by the means of several cocks adapted to the copper; it is clarified, and, if necessary, afterwards filtered.

The water thus saturated with gelatine is exposed to fire or steam in an open copper; the concentration is carried on till it has attained the consistency of sirop by ebullition, or evaporation, care being taken to agitate it that it may not adhere to the vessel: it is then poured into tin moulds, in which it cools, to be afterwards placed according to the state of the atmosphere, either in a stove, or in the open air, upon canvass or metallic frames, till it becomes perfectly desiccated.

For the evaporation, according to circumstances, Monsieur Derosne's evaporator may be used with success; and in order that even the shadow of an accident may be avoided, the condensing copper described above is supplied with an escape, in the upper part, for giving vent to the redundant steam or air, and which mechanism is controlled in the following manner.

Several circular iron plates are provided, a few inches in diameter, and more or less thick, each of which has a hole in the centre; if the steam escape too forcibly during the boiling, one of these plates is put upon the escape of the condensor, so that the orifice of the escape may correspond with the hole in the plate: this simple apparatus, whilst allowing the escape of the air, or steam, contained in the boiler, immediately controls its too violent release by the action of the heat. If one plate be insufficient, two or three are added, one upon the other; more than four are seldom required, and this feeble moderator is sufficient for avoiding bursting or explosion.

The muriatic acid is totally unnecessary in the process here described, which is unexceptionably salubrious, its residuum, moreover, having the property of being highly nutritious, and of imparting no corrosive and deleterious principle, as occurs in the employment of muriatic acid. [*Ibid.*

¶ *Remarks on Mr. White's experiments on the cohesion of cements; with a tabular view of their results, reduced to a common scale. By B. Bevan, Esq.*

To the editors of the Philosophical Magazine and Journal.

Gentlemen,—The papers on cements, communicated by Mr. White, and published in the Philosophical Magazine and Annals, N. S. vol. xi. pp. 264 and 333, are of considerable importance on account of the numerous facts they contain. They enable the architect and builder to know where, and in what manner, to apply the different kinds of cement, and the degree of stress which may safely be laid upon them.

A careful perusal of the numeral results will point out several common errors, in respect to the cohesive properties of Roman cement and pozzolano, under different modifications, and under various degrees of exposure to moisture.

And as you probably may be of opinion that an abstract of the results given in those papers, reduced to one common scale in a tabular form, may be acceptable to some of your readers, and save much time to individuals, I take the liberty of sending one.

		lbs.	Cohesive strength per inch. Mean.
Cement in bars, age 6 days,	1 dry -	474	
	2 variable -	360	356
	3 wet - -	234	
" age 47 days,	1 dry -	516	
	2 var. -	564	
	3 wet -	270	
" age 94 days,	1 dry -	210	
	2 var. -	618	380
	3 wet -	312	

" age 187 days,	1 dry -	534	519
	2 var. -	708	
	3 wet -	336	
Mean of the dry - -			433
variable - -			562
wet - -			288

	With salt water, - -	924
	With 51 per cent. of water, - -	330
	With 64 do. - -	215
	3 parts cement, 2 parts sand, -	456
	1 part cement, 1 part brickdust, -	312
Bricks	3 parts cement, 2 parts sand, 6 months,	375
	3 —— —— 2? - -	362
	All cement - 9 months,	360
	Paving bricks, best sort, -	253
	—— ——, seconds, - -	194
	Common building brick, London,*	43
	Common bricks, Soho, - -	412
Brick cylinders, laid in cement, -		27
—————— in cement and sand, -		68
——————————, -		48
——————————, -		53

Brick piers, laid in cement, 2 parts rough lime, 1 part, sand, 1½ parts,	1 month	4½
pozzolano, 3 parts, docking lime, 1 part,	6 weeks,	7
pure cement, - -		21
pozzolano, 1; stone lime, 1,		8¼
Atkinson's cement, 1; sand, 1,		25¼
ditto, - - -		49¼
cement, 4; lime, 1, -		17

The apparent deficiency of strength in these experiments, probably arose from the position of the resultant and strain in being on one side, instead of in the middle of the piers.

Force required to crush, per square inch.

		lbs.
P. 337.	A 14 inch brick pier, laid in cement	470
	Pozzolano, 3 parts; ground lime 1,	296
	Atkinson's cement 1; sand 1, -	410
	Pozzolano, 4; lime 1, -	638
	Ditto 3; Dorking lime 1, -	600
	Stone-lime 1; sand 3, -	500
	Portland stone pier, -	2300

* Stowbridge fire bricks have a strength of 790 lbs. per square inch. The bricks I used at Greenwich well were made at Fenny Stratford, and would support 715 lbs. per square inch; equal to the strength of Yorkshire stone.

A small error may be corrected, Phil. Mag. and Annals, vol. xi. p. 339, line 20, *for* 173½ tons, *read* 149 tons.

Yours, truly,
B. Bevan.

P. S. From the disproportions between the cohesive strength of pure cement and cement used in brick work, it is desirable that further experiments should be made on this subject.

¶ *Safety Tube for the combustion of the mixed gases Oxygen and Hydrogen, invented by M. Hummings.*

A cylinder, about six inches long, and three-quarters of an inch wide, filled with very fine brass wires, in length equal to the tube. A pointed rod of metal, one-eighth of an inch thick, is then forcibly inserted through the centre of the bundle of wires in the tube, by which they are wedged more closely together. The interstices between the wires, which are exceedingly small, are then, in effect, a series of metallic tubes of very minute diameter; the cooling and conducting power of these is far greater than could be produced in a cylinder of equal length even filled with discs of wire gauze, and there is unbroken continuity. All attempts to produce explosion of the gases in this tube, or to compel the flame to return through it, have been effectual. Before the Society of Arts, Mr. Hummings exploded the gases repeatedly in the improved safety chamber now employed in Gurney's blow-pipe, by permitting small portions of water from the well to enter with them, but he could not explode them in his improved tube under precisely the same circumstances, although they were ignited at the aperture (nearly three-quarters of an inch in diameter,) after the jet was removed.

Mr. Hummings kept the gases ignited at this large aperture until the extremity of the tube was in a state of active combustion, which was evident by the dense green flame produced; and although the cooling influence was then greatly diminished, no explosion occurred.

The simplicity of its construction will render the manufacture of the article easy and economical, and its perfect safety will enable the chemical operator to dispense with a very expensive and delicate article of apparatus, in the use of which there is always danger and uncertainty.

[*Phil. Mag. and Jour of Science, No.* 1, 3*d series.*

Trials of Chronometers at Greenwich, in 1831.

We can advance no better evidence of the advantage of the government offering rewards for the improvement of science than the results of the last year's trial of chronometers at the Royal Observatory, and contrasting with them the particulars of the trials in former years, showing the gradual improvement and accuracy of performance of

the several chronometers that gained the respective prizes. The public are aware that the lords of the admiralty give annual premiums to the three artists whose chronometers perform with the least variation from mean time, within prescribed limits. In December terminated the ninth annual trial of skill of the numerous artists employed in the construction of chronometers. The prizes were awarded to the following makers, whose chronometers at former periods have been repeatedly purchased by the government. The errors at the close of the trial, as computed by the astronomer royal, and determined by what is termed the trial number, were as follows:

Mr. Cotterell, Oxford street,	″2.93	Trial number.
Mr. Frodsham, jr., Change alley,	3.65	
Mr. Webster, Cornhill,	3.73	

But the actual error, on any of their rates during the year, did not amount to one second of time—a degree of accuracy unprecedented in three chronometers in former trials, in which more than five hundred have been submitted for observation: so perfectly were they adjusted, that either would have enabled a mariner to navigate a vessel round the world with less than one mile error in longitude at the close of such voyage. The errors in their rates were

Mr. Cotterell's - -	″0.70
Mr. Frodsham's - - -	0.86
Mr. Webster's - -	0.89

leaving a difference in the whole year, between the first and last, of nineteen hundredths of a second. To prove the accuracy and attention of the gentlemen of the Royal Observatory—a question having arisen as to the justness of awarding one of the prizes, the sum of the year's errors was revised, and the result was a difference of .066 decimal, or sixty-six thousandths of a second in the year's calculation; determining the prize to Mr. Webster, as proposed in the first instance.

We subjoin the performance of the chronometers for the last eight years' trials:—

1823.	First prize - -	″11.29
	Second do. - -	12.87
1824.	First do. - -	4.44
	Second do. - -	6.84
1825.	First do. - -	5.44
	Second do. - -	6.12
1826.	First do. - -	2.62
	Second do. - -	3.46
1827.	First do. - -	4.68
	Second do. - -	5.65
1828.	First do. - -	4.41
	Second do. - -	4.52
1829.	First do. - -	2.27
	Second do. - -	3.80
	Third do. - -	4.00

1830. First do.	- -	3.59
Second do.	- -	4.04
Third do.	- -	4.34

[*Phil. Mag.*

Substitute for Printing.

A new process has been discovered and brought into use at Brussels, whereby French books and journals may be printed with great facility and perfect accuracy. It consists of an operation by which, in less than half an hour, the whole of the letter press upon a printed sheet may be transferred to a lithographic stone, leaving the paper a complete blank. By means of a liquid, the letters transferred to the stone are brought out in relief within the space of another hour, and then, with the usual application of the ordinary printing ink, 1500 or 2000 copies may be drawn off resembling minutely the original typography. The immense advantages of this discovery, for which M. Mecus Vandermacien has solicited a patent, may be easily conceived. A first application of this discovery has been made by him upon the "Gazette des Tribunaux," which is to appear at Brussels under a new title.

[*Rep. Pat. Inv.*

Curious Clock.

The Journal of Geneva gives the following description of a clock exhibited in that city, and executed by M. Bianchi, of Verona. This machine, which is especially remarkable on account of its extreme simplicity, is composed only of a pendulum, a large wheel, two escapements, and a quadrature; such are the visible parts. We must, however, suppose that a pinion and a wheel make the communication between the great wheel and the quadrature, though we cannot see them. The pendulum at each vibration causes one of the escapements to advance the great wheel one tooth, which, after this movement, has a pause marking the dead second. As there is no metallic moving power to set the machine going, we find, on examining what keeps up the motion, that the pendulum, which is almost out of proportion with the clock, descends into a case, and there, at each vibration, the ball, or bob, that is furnished with a conductor, approaches alternately two poles, to which voltaic piles supply their portion of electricity. So that the pendulum, when once put in motion, retains it by means of the electricity alternately drawn from the two poles. This machine, which is equally simple and ingenious, is worthy of the attention of the artist. Perhaps other interesting results may be obtained by employing the electric fluid as a moving power, however slight the force such an agent may seem capable of communicating. [*Rep. Pat. Inv.*

The Iron of Borneo.

The iron found all along the coast of Borneo is of a very superior quality, which every person must know who has visited Pontiana or Sambas. At Bangermassing, it is, however, much superior; they have a method of working it which precludes all necessity of purchasing European steel. But the best iron of Bangermassing is not equal to that worked by the rudest Diak; all the best kris-blades of the Bugis rajahs and chiefs are manufactured by them; and it is most singular, but an undoubted fact, that the farther a person advances into the country, the better will be found all instruments of iron. Seljie's country is superior in this respect to all those nearer the coast; his golloks, spears, and kris-blades are in great demand.

There are forty-nine forges at work merely in the campong of Marpow, but the mandows and spears which he uses himself, and gives to his favourite warriors, are obtained further north. Those men live in a state of nature, building no habitations of any kind, and eating nothing but fruits, snakes, and monkeys, yet procure this excellent iron, and make blades sought after by every Diak, whose hunting excursions have in view the possession of the poor creatures, spear or mandow as much as his head, strange as it may sound.

Instruments made of it will cut through over wrought and common steel with ease. We have seen penknives shaved to pieces with them by way of experiment; and one day a wager of a few rupees having been made with Seljie, that he would not cut through an old musket barrel, he without hesitation put the end of it upon a block of wood and chopped it to pieces without in the least turning the edge of the mandow.

In the sultan of Cotti's house there are three muskets, formerly belonging to Major Mullen's detachment, which are each cut more than half through in several places by the mandows of the party which destroyed them. This circumstance being mentioned to Seljie, he laughed, and said that the mandows used on that occasion were not made of his iron, otherwise the barrels would have been cut through at every stroke.—*Abridged from an article in the Singapore Chronicle.*

¶ *Selections from Professor Babbage's Work "on the Economy of Machinery and Manufactures."*

Machine for making Pins.

Some further reflections are suggested by the preceding analysis, but it may be convenient previously to place before the reader a brief description of a machine for making pins, invented by an American. It is highly ingenious in point of contrivance, and, in respect to its economical principles, will furnish a strong and interesting contrast with the manufacture of pins by the human hand. In this machine,

a coil of brass wire is placed on an axis; one end of this wire is drawn by a pair of rollers through a small hole in a plate of steel, and is held there by a forceps. As soon as the machine is put in action—

1. The forceps draws the wire on to a distance equal in length to one pin: a cutting edge of steel then descends close to the hole through which the wire entered, and severs a piece equal in length to one pin.

2. The forceps holding the wire moves on until it brings the wire into the centre of the *chuck* of a small lathe, which opens to receive it. Whilst the forceps returns to fetch another piece of wire, the lathe revolves rapidly, and grinds the projecting end of the wire upon a steal mill which advances towards it.

3. After this first, or coarse pointing, the lathe stops, and another forceps takes hold of the half pointed pin, (which is instantly reliev-ed by the opening of the *chuck*,) and conveys it to a similar *chuck* of another lathe, which receives it, and finishes the pointing on a finer steel mill.

4. This mill again stops, and another forceps removes the pointed pin into a pair of strong steel clams, having a small groove in them by which they hold the pin very firmly. A part of this groove, which terminates at that edge of the steel clams which is intended to form the head of the pin, is made conical. A small round steel punch is now driven forcibly against the end of the wire thus clamped, and the head of the pin is partially formed by pressing the wire into the conical cavity.

5. Another pair of forceps now removes the pin to another pair of clams, and the head of the pin is completed by a blow from a second punch, the end of which is slightly concave. Each pair of forceps returns as soon as it has delivered its burthen; and thus there are always five pieces of wire at the same moment in different stages of advance towards a finished pin. The pins so formed are received into a tray, and whitened, and papered in the usual manner.

About sixty pins can thus be made by this machine in one minute; but each process occupies exactly the same time in performing.

Economy in manufacturing illustrated.

Among the causes which tend to the cheap production of any article, and which require additional capital, may be mentioned, the care which is taken to allow no part of the raw produce, out of which it is formed, to be absolutely wasted. An attention to this circumstance sometimes causes the union of two trades in one factory, which otherwise would naturally have been separated. An enumeration of the arts to which the horns of cattle are applicable, furnishes a striking instance of this kind of economy. The tanner who has purchased the hide separates the horns, and sells them to the maker of combs and lanterns. The horn consists of two parts, an outward

horny case, and an inward conical shaped substance, somewhat intermediate between indurated hair and bone. The first process consists in separating these two parts, by means of a blow against a block of wood. The horny exterior is then cut into three portions by means of a frame saw.

1. The lowest of these, next to the root of the hair, after undergoing several processes, by which it is rendered flat, is made into combs.

2. The middle of the horn, after being flattened by heat, and its transparency improved by oil, is split into thin layers, and forms a substitute for glass in lanterns of the commonest kind.

3. The tip of the horn is used by the makers of knife handles, and of the tops of whips, and for other similar purposes.

4. The interior, or core, of the horn, is boiled down in water. A large quantity of fat rises to the surface; this is put aside, and sold to the makers of yellow soap.

5. The liquid itself is used as a kind of glue, and is purchased by the cloth dressers for stiffening.

6. The bony substance, which remains behind, is then sent to the mill, and, being ground down, is sold to the farmers for manure.

Besides these various purposes to which the different parts of the horn are applied, the clippings which arise in comb making are sold to the farmer for manure, at about one shilling a bushel. In the first year after they are spread over the soil, they have comparatively little effect, but during the next four or five their efficiency is considerable. The shavings which form the refuse of the lantern maker, are of a much thinner texture: a few of them are cut into various figures and painted, and used as toys; for being hygrometric, they crawl up when placed in the palm of a warm hand, But the greater part of these shavings are also sold for manure, which, from their extremely thin and divided form, produce its full effect upon the first crop.

Manufacture of Eyes for Dolls.

The person examined on this occasion was Mr. Ostler, a manufacturer of glass beads, and other toys of the same substance, from Birmingham. Several of the articles made by him were placed upon the table, for the inspection of the committee of the House of Commons, which held its meetings in one of the committee rooms.

"Question. Is there any thing else you have to state upon this subject?

"Answer. Gentlemen may consider the articles upon the table as extremely insignificant; but perhaps I may surprise them a little by mentioning the following fact. Eighteen years ago, on my first journey to London, a respectable looking man in the city, asked me if I could supply him with doll's eyes; and I was foolish enough to feel half offended; I thought it derogatory to my new dignity as a manufacturer, to make doll's eyes. He took me into a room quite as wide,

and perhaps twice the length of this, and we had just room to walk between stacks, from the floor to the ceiling, of parts of dolls. He said, 'these are only the legs and arms; the trunks are below.' But I saw enough to convince me that he wanted a great many eyes; and as the article appeared quite in my line of business, I said I would take an order by way of experiment; and he showed me several specimens. I copied the order. He ordered various quantities, and of various sizes and qualities. On returning to the Tavistock hotel, I found that the order amounted to £500. I went into the country, and endeavoured to make them. I had some of the most ingenious glass toy-makers in the kingdom in my service; but when I showed the eyes to them, they shook their heads, and said they had often seen the article before, but could not make them. I engaged them by presents to use their best exertions; but after trying and wasting a great deal of time for three or four weeks, I was obliged to relinquish the attempt. Soon afterwards I engaged in another branch of business, (chandelier furniture,) and took no more notice of it. About eighteen months ago, I resumed the trinket trade, and then determined to think of the dolls' eyes, and about eight months since, I accidentally met with a poor fellow who had impoverished himself by drinking, and who was dying in a consumption in a state of great want. I showed him ten sovereigns, and he said he would instruct me in the process. He was in such a state that he could not bear the effluvia of his own lamp; but though I was very conversant with the manual part of the business, and it related to things I was daily in the habit of seeing, I felt I could do nothing by his description, (I mention this to show how difficult it is to convey, by description, the mode of working.) He took me into his garret, where the poor fellow had economized to such a degree that he had actually used the entrails and fat of poultry from Leadenhall market to save oil, (the price of the article having been latterly so much reduced by competition at home.) In an instant, before I had seen him make three, I felt competent to make a gross; and the difference between his mode and that of my own workmen was so trifling, that I felt the utmost astonishment.

"Quest. You can now make dolls' eyes?

"Ans. I can. As it was eighteen years ago that I received the order I have mentioned, and feeling doubtful of my own recollection, though very strong, and suspecting that it could [not] have been to the amount stated, I last night took the present reduced price of that article, (now less than half what it was then,) and calculating that every child in this country not using a doll till two years old, and throwing it aside at seven, and having a new one annually, I satisfied myself that the eyes alone would produce the circulation of a great many thousand pounds. I mention this merely to show the importance of trifles, and to assign one reason, amongst many, for my conviction, that nothing but personal communication can enable our manufactures to be transplanted."

Tanning.

The process of tanning will furnish us with a striking illustration of the power of machinery in accelerating certain processes in which natural operations have a principal effect. The object of this art is to combine a certain principle, called *tannin*, with every particle of the skin to be tanned. This, in the ordinary process, is accomplished by allowing the skins to soak in pits containing a solution of tanning matter; they remain in the pits six, twelve, or eighteen months; and in some instances (if the hides are very thick) they are exposed to the operation for two years, or even during a longer period. This length of time is apparently required in order to allow the tanning matter to penetrate into the interior of a thick hide. The improved process consists in placing the hides, with the solution of tan, in close vessels, and then exhausting the air. The consequences of this is to withdraw any air which might be contained in the pores of the hides, and to employ the pressure of the atmosphere to aid capillary attraction in forcing the tan into the interior of the skins. The effect of the additional force thus brought into action can be equal only to one atmosphere; but a further improvement has been made: the vessel containing the hides is, after exhaustion, filled up with a solution of tan; a small additional quantity is then injected with a forcing pump. By these means any degree of pressure may be given which the containing vessel is capable of supporting; and it has been found, that by employing such a method, the thickest hides may be tanned in six weeks or two months.

The same process of injection might be applied to impregnate timber with tar, or any other substance adapted to preserve it from decay; and if it were not too expensive, the deal floors of houses might be thus impregnated with alumine or other substances, which would render them much less liable to be accidentally set on fire. Some idea of the quantity of matter which can be injected into wood by great pressure may be formed from considering the fact stated by Mr. Scoresby respecting an accident which occurred to a boat of one of our whaling ships. The line of the harpoon being fastened to it, the whale in this instance dived directly down, and carried the boat along with him. On returning to the surface, the animal was killed, but the boat, instead of rising, was found suspended beneath the whale by the rope of the harpoon; and on drawing it up, every part of the wood was found to be so completely saturated with water as to sink to the bottom.

Durability of Watches.

The durability of common watches, when well made, is very considerable. One was produced, in "*going order*," before a committee of the House of Commons, to inquire into the watch trade, which was made in the year 1660; and there are many of ancient date in the possession of the Clock-makers' Company, which are actually kept going. The number of watches manufactured for home con-

sumption was, in the year 1798, about 50,000 annually. If this supply was for Great Britain only, it was consumed by about ten and a half millions of persons.

Process in the art of Needle Making.

To arrange 20,000 needles thrown promiscuously into a box, mixed and entangled with each other in every possible direction, in such a form that they shall be all parallel to each other, would at first sight appear a most tedious occupation; in fact, if each needle were to be separated individually, many hours would be consumed in the process. Yet this is an operation which must be performed many times in the manufacture of needles, and it is accomplished in a few minutes by a very simple *tool;* nothing more being requisite than a small flat tray of sheet iron, slightly concave at the bottom. The needles are placed in it, and shaken in a peculiar manner, by throwing them up a very little, and giving at the same time a slight longitudinal motion to the tray. The shape of the needles assists their arrangement, for if two needles cross each other, (unless, which is exceedingly improbable, they happened to be precisely balanced,) they will, when they fall to the bottom of the tray, tend to place themselves side by side, and the hollow form of the tray assists this disposition. As they have no projection in any part to impede this tendency, or to entangle each other, they are, by continual shaking, arranged lengthwise in three or four minutes. The direction of the shake is now changed, the needles are but little thrown up, but the tray is shaken endwise, the result of which is, that in a minute or two the needles which were previously arranged endwise, become heaped up in a wall, with their ends against the extremity of the tray. They are now removed by hundreds at a time, by raising them with a broad iron spatula, on which they are retained by the fore finger of the left hand. During the progress of the needles towards their finished state, this parallel arrangement must be repeated many times, and unless a cheap and expeditious method had been devised, the expense of manufacturing needles would have been considerably enhanced.

Another process in the art of making needles furnishes an example of one of the simplest contrivances which can come under the denomination of a *tool.* After the needles have been arranged in the manner just described, it is necessary to separate them into two parcels, in order that their points may all be in one direction. This is usually done by women and children. The needles are placed sideways in a heap on a table, in front of each operator, just as they are arranged in the process above described. From five to ten are rolled towards the person by the fore finger of the left hand; this separates them a very small space from each other, and each in its turn, is pushed lengthwise to the right or to the left, according as its eye is on the right or left hand. This is the usual process, and in it every needle passes individually under the finger of the operator. A

small alteration expedites the process considerably; the child puts on the fore finger of its right hand, a small cloth cap or finger-stall, and rolling out of the heap from six to twelve needles, he keeps them down by the finger of the left hand, whilst he presses the fore finger of the right hand gently against their ends: those which have the points towards the right hand stick into the finger-stall, and the child removing the finger of the left hand, slightly raises the needles sticking into the cloth, and then pushes them towards the left side. Those needles which had their eyes on the right hand do not stick into the finger cover, and are pushed into the heap on the right hand previously to the repetition of this process. By means of this simple contrivance each movement of the finger from one side to the other carries five or six needles to their proper heap; whereas, in the former method, frequently only one was moved, and rarely more than two or three were transported at one movement to their place.

Meteorological Observations for October, 1832.

Moon.	Days.	Therm.		Barometer.		Dew point	Wind.		Water fallen in rain.	State of the weather, and Remarks.
		Sun rise.	2 P.M.	Sun rise.	2 P.M.		Direction.	Force.		
				Inches	Inches.				Inches.	
☽	1	61°	57°	29.70	29.65	57	W.	Moderate.	.40	Cloudy—rain—fly'g. cld's.
	2	60	46	.65	.65	46	W.	do.		Flying clouds.
	3	56	44	.65	.65	44	W.	Blustering.	.40	Foggy—clouds—rain in [night.
	4	66	47	.65	.65	47	SW.	do.		Clear day.
	5	68	51	.80	.85	51	W.	Moderate.		Clear day.
	6	68	52	.85	.85	52	W.	do.		Foggy—clear.
	7	59	58	.75	.75	58	SE.	do.		Fog—rain.
	8	58	53	.90	30.00	53	NW. SE.	do.		Cloudy day.
○	9	60	58	30.10	.15	58	SE	do.		Cl'dy; drizzle; rain in n't.
	10	76	66	.00	29.90	66	S.	do.		Rain—flying clouds.
	11	59	62	29.70	.70	62	SW.	Blustering.		Cloudy; rain; flying cl'ds.
	12	64	49	30.00	30.00	49	W.	do.		Clear day.
	13	62	49	.00	.00	49	W.	Moderate.	.20	Cloudy—rain.
	14	58	45	.00	.10	45	W.	do.		Cloudy—clear.
	15	60	33	.30	.30	33	W.	do.		Light frost—clear.
☾	16	57	42	.30	.30	42	SW.	do.		Clear—white frost—clear.
	17	63	51	.14	.10	53	SW.	do.		Fog—clear.
	18	70	61	.00	.00	61	SW.	do.		Fog—clear.
	19	70	61	.05	.10	61	SE.	do.		Lightly cl'dy. flying cl'ds.
	20	72	62	.00	29.90	62	S.	do.		Cloudy—clear.
	21	68	53	29.90	30.00	53	S.	do.		Clear day.
⊗	22	49	51	30.00	29.90	51	NE.	Blustering.	.40	Rainy day.
	23	58	52	29.70	.70	52	W.	do.		Cloudy day.
	24	52	30	.90	.90	30	N. NW.	do.		Cloudy—flying clouds.
	25	54	34	.90	.90	34	NW.	do.		Cloudy—flying clouds.
	26	42	21	30.25	30.34	21	NW.	do.		Clear day.
	27	52	40	.90	.10	40	W. SW.	Moderate.		Cloudy—clear.
	28	42	27	.10	.20	27	NW. W.	do.		Cloudy—clear.
	29	52	31	.30	.30	31	N.	Blustering		Clear day.
	30	58	38	.30	.30	38	NW. W.	Moderate.		Hazy—sun red.
	31	56	38	.30	.20	38	W.	Calm.		Clear—hazy.
	Mean	46.67	50.35	29.98	29,96	47.2			1·40	

		Thermometer.	Barometer.
Maximum height during the month,		76. on 10th.	30.34 on 26th
Minimum	do. . .	28. on 29th.	29.65 on 1st, 2nd, 3d, 4th.
Mean	do. . .	53.01 . .	29.98

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